SCIENTIFIC AMERICAN

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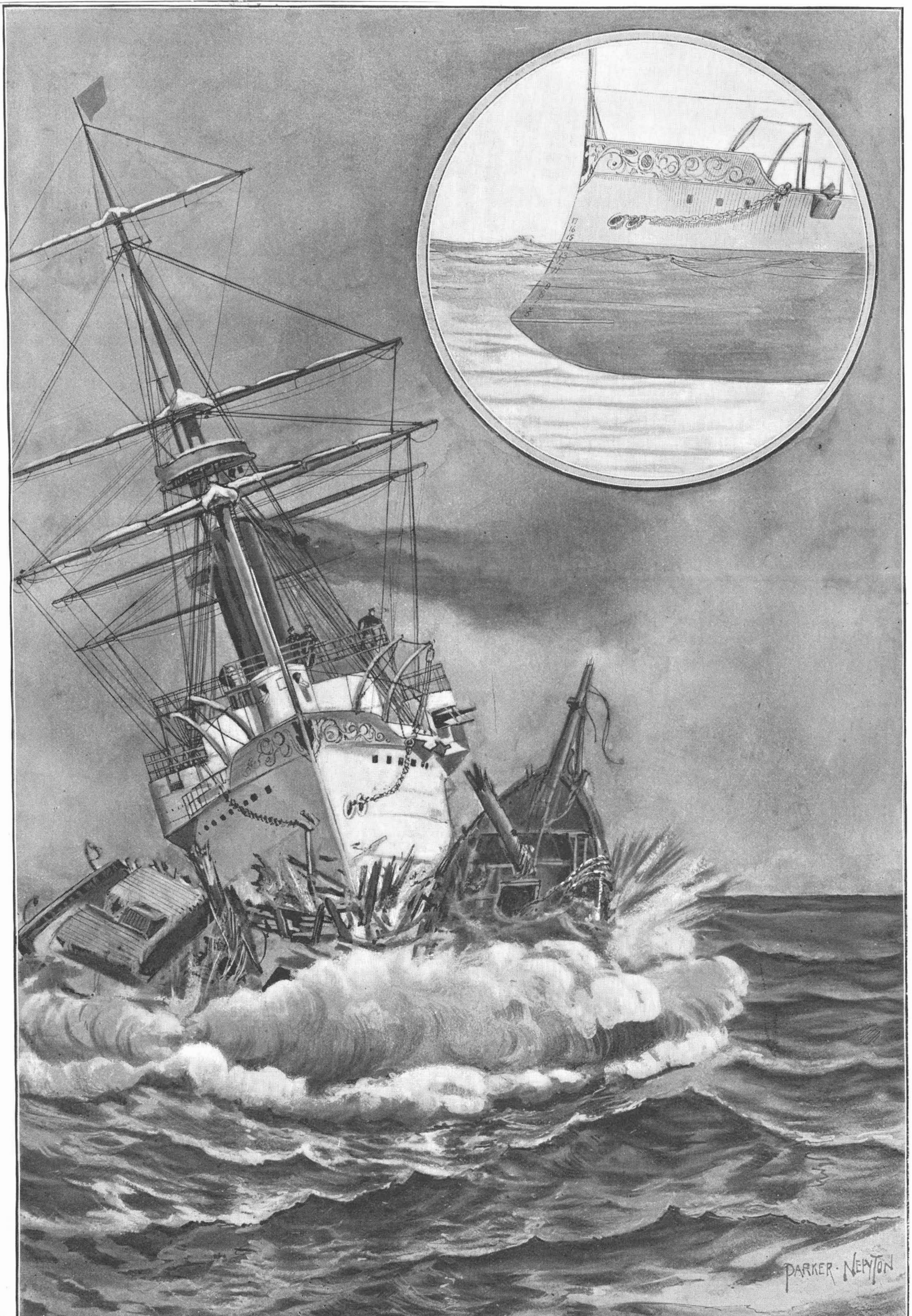

THE UNITED STATES WAR SHIP ATLANTA RAMMING A DERELICT.—[See page 183.]

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NEW YORK, SATURDAY, SEPTEMBER 22, 1894.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF
SCIENTIFIC AMERICAN SUPPLEMENT
No. 977.

For the Week Ending September 22, 1894.

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PATENTS FOR MINOR INVENTIONS.

The present policy of the Patent Office, it is well known, takes the direction of the refusing to issue patents for what the examiners may deem devices of insufficient degree of invention. The tendency is to restrict the granting of patents, to make the Patent Office a species of court, before which the merits of the invention will undergo adjudication before the inventor is given the small privilege he asks, which privilege is simply the right to use the federal courts for the determination of his rights in an invention. The Patent Office, in other words, constitutes itself a kind of guardian of the public against the inventor, the assumption being apparently that the granting of a patent, where not fully deserved, is in some mysterious way an imposition upon the rights of the people at large. Several things militate against the justice of this conception and of actions based upon it. Since the Patent Office began to issue patents in any quantity and since the time when the federal courts were called upon to give decisions in cases relating to patents, many opinions have been rendered by the best judges the land has ever seen, in which the rights of the inventor, the merits of his work, and the expediency of protecting him in the exercise of his genius were enlarged upon. It is especially in the decisions of the judges of some decades past that these statements of opinions favorable to the inventor are to be found. As time went by and patents multiplied in number, the courts seem to have adopted a more severe treatment of inventions. This was especially the case with the Supreme Court of the United States. But more recently, while the Patent Office has taken the rigorous and restricted treatment of the matter, the courts seem inclined to revert to the earlier opinions, and some very gratifying decisions are the result.

In the Official Gazette of the United States Patent Office of September 11, 1894, a decision is published exemplifying what we have just said. In 1878 a patent was granted to an inventor for a corncob pipe having its exterior interstices filled with a plastic self-hardening mass, which rendered the pipe durable and efficient. This certainly was a minor invention and may be taken as typical of a class which the Patent Office in its present practice views with disfavor. It seemed to require but little invention to smooth the surface and fill the interstices of a corncob pipe. In a decision rendered April 20, 1894, on this patent, Judge Thayer, of the Eastern District of Missouri, Eastern Division, affirmed its validity and held that it was infringed by a specified structure made by the defendant in the case.

The first clause of the decision referred to the patent and its construction. The judge states broadly that the patent is for a new article of manufacture, which, without involving a high order of invention, leads to the production of a new article. Then, seeking to determine by the correct theory the degree of invention by the history of the object, he finds that these pipes had a large demand immediately, and that a new industry on a small scale, but sufficient to give employment to a number of persons, was established. The patentee, as the first person to manufacture a pipe of this character, is held to be entitled to a broad interpretation of his patent, one sufficiently broad to prevent others from availing themselves of its merits by a merely colorable departure from what the patent described.

In the last years of the life of the patent the patentee has at least the satisfaction of eliciting a most excellent opinion from the court, an opinion which might be commended to the examiners of the Patent Office as a guide in rendering decisions in these cases of minor inventions, for nothing is more certain than that it is utterly impossible to tell what the future of an invention will be. The smallest and apparently the most insignificant invention may have widely different value from anything which appears on its face. It is often in the very simplicity of an invention or device that the genius of invention lies. The doctrine of the criminal law is that it is better for many criminals to escape than for one innocent man to be punished. A parallel doctrine might apply to inventors and their inventions. It would be better to grant many patents, destined ultimately to be declared invalid, than to omit or to refuse to grant a patent for a single invention of merit. The true function of the Patent Office, broadly stated, is to grant, not to refuse, patents. The granting of the patent merely gives the inventor standing in the courts. It involves no possibility of imposition on the public, but simply puts it in the power of the inventor to protect himself in the exercise of such rights as he may possess.

The Work of Dust.

Dust has a very large share in nearly all the phenomena of the earth's atmosphere. It is what makes the clear sky appear blue; and when we look up into the sky we see the dust in the atmosphere illuminated by the sun. There is nothing else before us that can permit the light to reach the eye. Light goes invisible, straight through all gases, whatever their chemical composition. The dust catches it, reflects it in every direction, and so causes the whole atmosphere to appear clear, in the same way that it makes the sunbeam visible in the darkened room. Without dust there would be no blue firmament. The sky would be as dark as or darker than we see it in the finest moonless nights. The glowing disk of the sun would stand immediately upon this dark background, and the same sharp contrast would prevail upon the illuminated surface of the earth—blinding light where the sun's rays fall and deep black shadows where they do not. Only the light of the moon and the stars, which would remain visible in the daytime, would be able to temper this contrast in a slight degree. The illumination of the earth's surface would be like that we see with the telescope on the lunar landscapes; for the moon has no atmospheric envelope that can hold floating dust. We then owe to dust the even moderately tempered daylight, adapted now to our eyes; and it is that which contributes much to the beauty of our landscape scenery.

But if dust makes the sky appear clear, why is the color of the sky blue? Why does dust, of the different constituents of white sunlight, reflect the blue rather than the green, yellow and red? This fact is connected with the size of the dust particles. Only the finest dust settles so slowly that it can be spread everywhere by means of the air currents, and can be found constantly in all strata of the atmosphere; and special importance can be ascribed only to these finest particles. The coarse parts soon fall to the ground. Let us consider the fine mechanism of light, the extremely short ether waves which determine its existence. These waves, although they are of even less than microscopic size, are not all equally long. The shortest are those that give blue light, while all the other colors are produced by longer waves. The fine atmosphere dust contains many particles which are large enough to reflect the short blue ether waves, fewer than can reflect green and yellow, and still fewer large enough to reflect the long red waves. The red light, therefore, goes on almost without hindrance, while the blue is more liable to be diverted, and thus to reach the eye. A similar phenomenon may be observed on a larger scale on water which is roughened with waves of different lengths, and on which pieces of wood are floating. The pieces of wood stand in the same relation to the water waves as the dust particles to the ether waves. The great long waves pass the blocks undisturbed, only rocking up and down; while the finer ripples of the water are turned back, as if the blocks were firm walls.

The finest dust thus appears blue. There is much coarse dust in large towns, when the sky over them is often gray, while only the finest blue dust is carried up in the country. The dust is also variously assorted at different heights above the surface of the earth. The coarser dust will be found at the lower levels, where it is produced. On mountains we have most of the dust beneath us, while the rarefied air can sustain only the finest floating particles. Hence the sky on high mountains is clear and deep blue, even almost black, as if it were without dust. Only when we look at the lower strata, toward the horizon, does the color pass into gray.

Why is the sky in Italy and the tropics of a so much deeper blue than that of Western Europe? Is the dust there finer? It is really so; not that a finer quality of dust is produced there, but because in the moist climate of the North Sea countries the dust cannot float long in the air without being charged with water and made coarser, while in warmer countries water exists in the air as vapor and does not become condensed as a liquid on the dust. Only when it is carried by the air currents into the higher strata and is cooled there, does it thicken into clouds. With this we come to the most important function of dust in our atmosphere—the part which it has in the function of rain, by reason of vapors condensing upon it. It can be affirmed with certainty that all the water which the sun causes to evaporate on the surface of the sea and on the land is condensed again on dust, and that no raindrop falls unless it had a particle of dust as its primary nucleus.

Without dust there would be no condensation of water in the air—no fog, no clouds, no rain, no snow, no showers. The only condensing surface would be the surface of the earth itself. Thus the trees and plants and the walls of houses would begin to trickle whenever cooling began in the air. In winter all would be covered with a thick icy crust. All the water which we are accustomed to see falling in rainpours or in snow would become visible in this way. We should at once feel on going out of doors that our clothes were becoming wet through. Umbrellas would be useless. The air, saturated with vapor, would penetrate the interior of houses and deposit its water on everything in them. In short, it is hard to conceive how different everything would be, if dust did not offer its immeasurable extent of surface everywhere to the air. To this we owe it that the condensation of water is diverted from the surface of the earth to the higher, cooler atmospheric strata.—Popular Science Monthly, from Die Gartenlaube.

The Colonial Exhibits at Antwerp.

The colonial exhibits at Antwerp are so full, and are brought so near together, that taken by themselves they form one of the most instructive factors of the whole exposition. France is particularly well represented by the products from her Asiatic domain. It is plain from the variety of fabrics made of it and the quantity of the raw fiber that ramie is one of the most valuable exports of Cochin China; not only is it manufactured into bags, hammocks, and hose for fire engines, but into the finest, most delicate cloth. The fiber of the banana is also used there for some of these purposes. Elephants' tusks and deer's horns, tortoise shells and birds of brilliant plumage are among the exports which the workmen of Paris elaborate into expensive trifles.

Tonkin contributes quantities of silk in long yellow, white and red hanks, also some beautiful tissues in silk; specimens of coal and antimony from there give evidence of rich mines.

Tea from Indo-China, indigo and gum copal from Senegal, sugar, coffee, cocoa and cotton from Guadeloupe, dyewoods from Annam, and caoutchouc from Madagascar, lying side by side, make it clear why the French republic finds it advantageous to have her flag planted on islands and continents all around the globe. The beautiful woods made into mosaics testify to the skill of some of her Eastern subjects; and so does the room fitted up with the prettiest rattan furniture that I ever saw; the chairs made in Tonkin have blue and yellow strands blended with much taste; a sofa of red and yellow rattan came from Madagascar; strong chairs, with their frames made of large pieces of bamboo, and the seats and backs of a firm woven fabric, were made in Cambodia. There are tables, too, of like manufacture, and the whole display suggests no end of comfort in a summer country house.

Portugal has not only fruits, maize, baskets, coffee, skins, etc., to show from her Congo possessions, but photographs of clothed and civilized-looking natives, who seem to have advanced considerably beyond those imported from the Free State. The lace and embroidery from the Madeiras are not inferior to those from Lisbon.

The corner occupied by the Dutch East Indies is full of interest. The quantities of clove, nutmeg, cinnamon, tea and coffee are no surprise, nor are the stacks of bamboo, but bamboo bridges do look queer. They are common in Java, I judge, for here are models of those in different parts of the island; they are beautifully made; one is covered, and all have a considerable span and breadth. Finely executed photographs and paintings of fair merit testify to the artistic taste of the people in Batavia.

The specimens of woods from a number of the colonies are noteworthy. They possess a variety of valuable qualities, perhaps none more than the pyinkado, which is shown in large planks and in paving blocks, in the Indian section of the English department, for it comes from Burma.

This timber is produced by a large tree belonging to the order Leguminosae, and sub-order Mimosae. Large claims are made for it by P. J. Carter, "the conservator of forests in the Pega Circle," who states that the crushing strain per square inch it will resist compares thus with some other timber:

	Tons.
Pyinkado	5,208
Teak	2,838
Kari (eucalpytus)	5,140
Oak	3,411

Its durability is proved by the fact that it was used in 1877 for sleepers on the Burma State Railway, and most of them are still sound. This timber can be bought in Rangoon at $20 a ton for small planks suitable for conversion into paving blocks.

Along with this wood there is a small collection of beautiful fabrics in silk and wool from Indian looms, and some wood and metal work, such as are found everywhere in Oriental shops. In general, it must be said that from anything to be seen here, one would get a very false notion of the resources of the English colonies. That they are almost boundless was the impression made by the magnificent array sent to Chicago from Canada, Ceylon and Australia. Here they do not compare favorably with those of the minor powers already mentioned.

It is clear from a study of these colonial exhibits, brought from the four quarters of the globe, that there has come to be a much wider distribution of products than was to be found a few years ago. For example, tobacco and Indian corn are sent from many of them; coffee, tea and sugar are now cultivated far from the regions where they are indigenous.

It would seem to be a foregone conclusion that all these nations which have possessions in Asia, Africa, Polynesia and the other important islands near or distant from their own shores, will soon be independent of each other as far as the supply of liquors, tobacco, food and clothing for their people is concerned. It looks as if the day when princely fortunes can be made from the exportation of certain commodities to every part of the civilized world were passed. A prophet might be able to discover in these facts signs that the very unequal distribution of material things is to be changed by what might be called a natural method, and as a result the value set upon them may be lessened. A. D.

The Great Falls of Labrador.

The Toronto Daily Mail gives a dispatch from Quebec, dated August 31, containing the following interesting information:

Sixty thousand square miles of an iron-bearing formation, a new lake larger than Grande Lac Mistassini, and the proof of the fact that the big falls of the Hamilton River are the largest in America, if not in the world, are among some of the many discoveries of value made by Messrs. Low and Eaton on their sixteen months' exploration of the interior of the great Labrador peninsula, which has terminated by the return of the explorers to Quebec and their disbandment here to-day. After traversing Labrador last year from south to north, and sailing from Ungava Bay to Hamilton Inlet, where they spent the winter, Messrs. Low and Eaton ascended the Hamilton River to the grand falls on ice, and succeeded in taking a splendid lot of photographs of it with ice cones and other surroundings. The remains of the burned boat belonging to Bowdoin College expedition were found below the falls, and, further on, the bottle containing a record of their trip to that point.

The river falls 800 feet in less than six miles, with one clear steep fall of more than 300 feet. The stream above the falls is as large as the Ottawa. Below the falls it narrows into a canyon of only 30 or 40 feet wide, with steep walls on either side, hundreds of feet high. Mr. Low brought back beautiful specimens of labradorite of the most valuable kind of the gem. It exists in large quantities.

The iron ore deposits to which reference has been made extend from latitude 50 to Ungava, and are very rich. Whole mountains of the ore were found corresponding with the ore of Marquette, Michigan, and containing millions of tons. The large Lake Michikamaw, in the northeast, is more than 100 miles long, not narrow and full of islands like Mistassini, but from 30 to 50 miles wide. Several lakes larger than Lake St. John were seen by the party. The country to the north is a perfect network of waterways, and these contain such fish in abundance as ouananiche brook and lake trout, whitefish, etc.

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court—Eastern District of Missouri, Eastern Division.

H. TIBBE & SON MANUFACTURING COMPANY v. MISSOURI COB PIPE COMPANY et al.

Letters Patent No. 208,816, granted July 9, 1878, to Henry Tibbe, for a corncob pipe having its exterior interstices filled with a plastic self-hardening mass, which rendered the pipe durable and efficient.

Thayer, J.

The Patent and its Construction.—This patent is for a new article of manufacture, and although it did not involve a high order of invention, yet it led to the production of a new article—namely, a corncob pipe having its exterior interstices filled with a plastic self-hardening mass, which rendered the pipe more durable and efficient. (Tibbe & Son Mfg. Co. v. Heineken, 47 O. G., 1221; 43 Fed. Rep., 75; Tibbe & Son Mfg. Co. v. Lamparter, 61 O. G., 427; 51 Fed. Rep., 763.) Pipes thus made immediately came into great demand, and the result of the invention has been the establishment of a new industry, not on a large scale, but sufficient to give employment to a considerable number of persons. Tibbe was the first person who conceived the idea of filling the exterior interstices of the cob so as to render the pipe more durable. He was the first manufacturer of a pipe of that character. He is accordingly entitled to a liberal interpretation of his claim—such an interpretation as will protect him during the life of the patent in the manufacture of what he has invented, and such an interpretation as will prevent others from appropriating the substance of his invention by a colorable departure from the process of manufacture which he describes. The fact that several attempts have been made by persons engaged in the manufacture of corncob pipes to appropriate the idea which was first suggested by Tibbe and yet to evade the claim of his patent by one means or another inclines the court to scrutinize closely and to view with suspicion all processes of making corncob pipes in which the exterior interstices are filled with a gummy or mucilaginous substance of whatsoever nature. In view of the liberal construction which the patent is entitled to receive, the court holds that finely pulverized cornmeal made of parched corn and mixed to any considerable extent with liquid shellac must be regarded as a plastic self-hardening cement, within the meaning of the Tibbe patent, if such a mixture is used to fill the exterior cavities of the cob. Such a mixture undoubtedly sets or hardens, although the elements do not unite chemically, and by so hardening and adhering to the cavities the pores of the cob are closed and the fundamental feature of Tibbe's invention is appropriated. In the case of Tibbe & Son Mfg. Co. vs. Lamparter, supra, this court held that a mixture of cob dust and corn starch, when treated with alcohol and used as a filler, was an infringement of the Tibbe patent, and that it made no difference whether the mixture was made before it was applied to the cob or whether it was made in the act of applying it. The same ruling was repeated on the application for a preliminary injunction in this case.

The Facts.—After a careful perusal of the evidence produced on the final hearing of the case, the court has become satisfied that when liquid shellac is applied to the exterior surface of the cob, according to the process now in use by the defendants, it penetrates to some extent into the finely pulverized cornmeal, with which the interstices have previously been filled, and thereby forms a mixture which hardens and adheres to the cavities and effectually closes the pores of the cob. I have no doubt that it is true that there are many cavities that are of such depth that the liquid shellac does not penetrate to the bottom of the same at their deepest point. On the other hand it is evident that many of the cavities are so shallow that the liquid does penetrate practically to the bottom of the cavity, and that it serves to fill the entire space with a homogeneous mass which is self-hardening. It must also be borne in mind that the cavities of the cob at their point of greatest depth are quite shallow and that the sides thereof slope, so that in any event it seems more probable that by the application of liquid shellac a considerable portion of the cornmeal in each cavity is saturated and formed into a cement. Enough is so saturated to effectually hold the filling in place and bind it to the cob. I can conceive of no sufficient reason for filling the cavities with cornmeal and then applying liquid shellac unless it is intended to penetrate the filler to some extent and make it adhesive and self-hardening.

The court does not consider it necessary to establish the charge of infringement that the proofs should show that the liquid shellac penetrates to the bottom of all the cavities and forms throughout each cavity a homogeneous mass. It is sufficient, the court thinks, that enough of the mass is permeated by the liquid to change its orginal character in part, bind it to the cavity and effectually close the pores of the cob. Upon the whole, therefore, the court has concluded that the charge of infringement is established and that a decree should be rendered in favor of the complainant.

It is so ordered.

How to Silver Mirrors.

BY J. MILLER.

The glass for making mirrors must have its surface optically worked. The following solutions are required, viz.:

(a) Eighty grains of nitrate of silver dissolved in two ounces distilled water.

(b) Eighty grains of pure caustic potash dissolved in two ounces distilled water.

Ammonia solution is added to a, drop by drop, continually stirring, until the whole of the silver is deposited and redissolved. When all the silver has been redissolved, the solution becomes clear. The potash solution, b, is then added, when the solution again becomes black. More ammonia solution is added drop by drop, stirring as before. The slower the ammonia is added, the finer the division of the silver is. When the solution again becomes clear, the action is complete. A weak solution of nitrate of silver is then added, drop by drop, until a very pale brown color is attained. Errors may be corrected by adding more silver or ammonia as may be necessary. The silver should be slightly in excess in the final solution. This solution should not be kept, as it becomes a powerful explosive.

Filtering is not recommended. Two and three-quarter ounces of solution are taken, and water added to make it up to eight ounces. The glass for the mirror having been made chemically clear with nitric acid, and washed in distilled water, is placed in a bath face downward, but supported, to prevent the face touching the bottom of the bath. It is then covered with the solution for a few minutes. Half an ounce of reducing solution (ten per cent solution of sugar of milk or grape sugar) is then taken, and the solution from the bath poured into it. It is then poured back carefully over the mirror, avoiding the formation of air bubbles, when the deposition of silver begins to take place, and the solution becomes muddy. The slower the action takes place, the harder the deposit. Leave until all the silver has been deposited, then pour off the solution, wash with distilled water several times. Dry carefully to avoid markings, and polish the face of the mirror with rouge when it is completed, and may be kept for use wrapped in velvet. Two mirrors were successfully made by the demonstrator.—South London Society.

AN ANCIENT LOCOMOTIVE.

BY W. F. DURFEE.

There is a general belief among mechanicians that vehicles containing within themselves the means of their own propulsion are of comparatively recent origin; and the fact of the adhesion of the rims of their wheels to the earth or a supporting rail being sufficient to enable adequate power applied to the wheels to move the vehicle was a discovery of not earlier than the middle of the last century; but in this instance the writers on locomotive machines have not dived deep enough or stayed down long enough among the records of antiquity to discover the bottom facts in the history of such mechanisms.

The first locomotive, or self-moving vehicle, of which we have any account was the invention of Hero of Alexandria, who lived about 2,000 years ago. In his work descriptive of automatic or self-moving machines, there is illustrated a shrine of Bacchus mounted upon three wheels concealed within its base. Fig. 1 is an elevation of this shrine, which was crowned with a canopy, about which figures of dancers were made to move by hidden mechanism. Fig. 2 is a vertical section of that part of the shrine below the canopy, and exhibits the propelling apparatus of this ancient locomotive machine. Within the base, are seen two of the supporting wheels; the driving wheel nearest the eye having been removed. On the axle of the driving wheels was the drum, b, about which was wound the rope, a, which passed upward through the space, t, on one side of the shrine and over the pulleys, r r, and was fastened to the ring, c, of the ponderous lead weight, d, which rested upon a quantity of dry, fine sand. The escape of this sand through a small hole in the middle of the floor of the compartment containing it allowed the lead weight, d, to gradually descend, and by pulling upon the cord, a, caused the shrine to move slowly forward in a straight line.

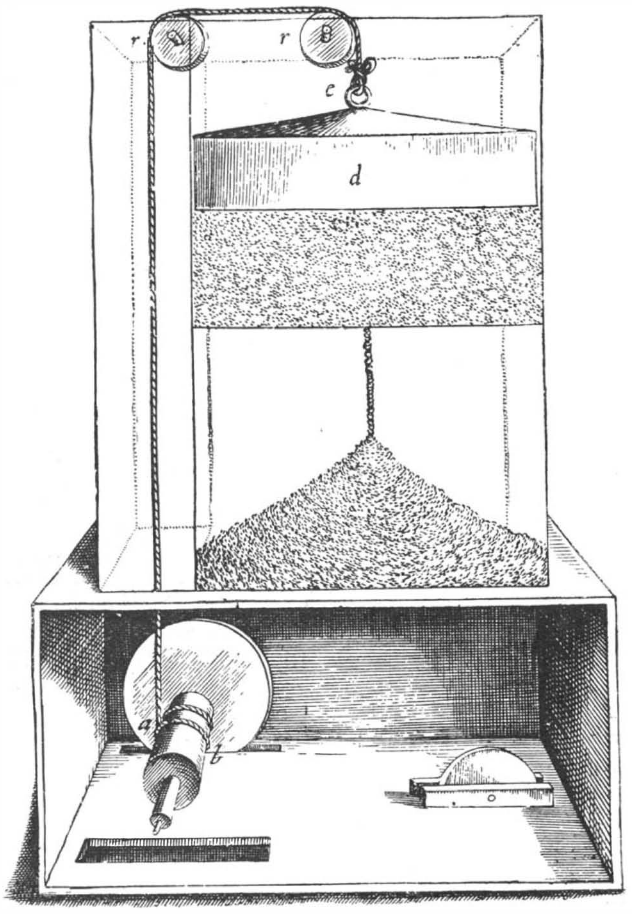


Fig. 2.—THE SHRINE OF BACCHUS—SECTION SHOWING THE PROPELLING MECHANISM.

Hero describes the following method of arranging and proportioning the wheels in case it was desired that the shrine move in a circular path: In Fig. 3 the rectangle, e, f, g, h, represents the outline of the base of the shrine; its three supporting wheels being indicated by the lines, o p, s t, and x y, the first and second being the driving wheels. If the shrine was required to move in the circumference of the circle, r, v, o, whose center is at c, Hero shows that the driving wheel nearest the center, c, must have a diameter determined by drawing the radii, o c and p c, from the extremities of the diameter of the outer driving wheel, o p, and then drawing the line, s t, through the point, n, at right angles to the common axle, a c, of the driving wheels and the length of this line defined by the radii, o c and o p, will be the diameter of the wheel required. It is obvious that the common axis, a c, of the driving wheels, o p and s t, must have an inclination in a vertical plane fixed by the diameters of these wheels. It is also necessary that the axis of the third wheel, x y, should be in the same vertical plane with the radial line, c d.

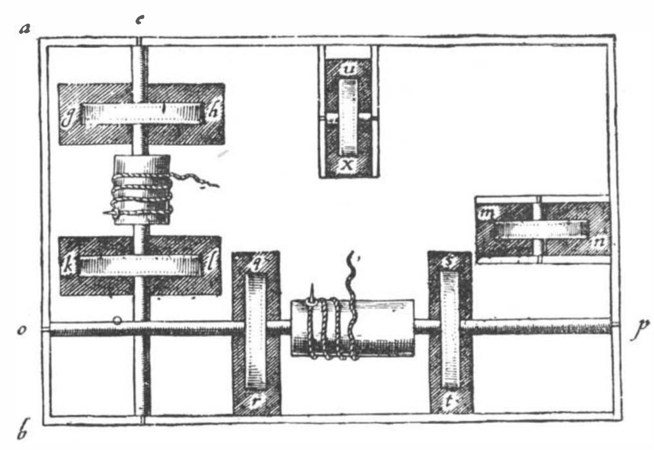


Fig. 4.

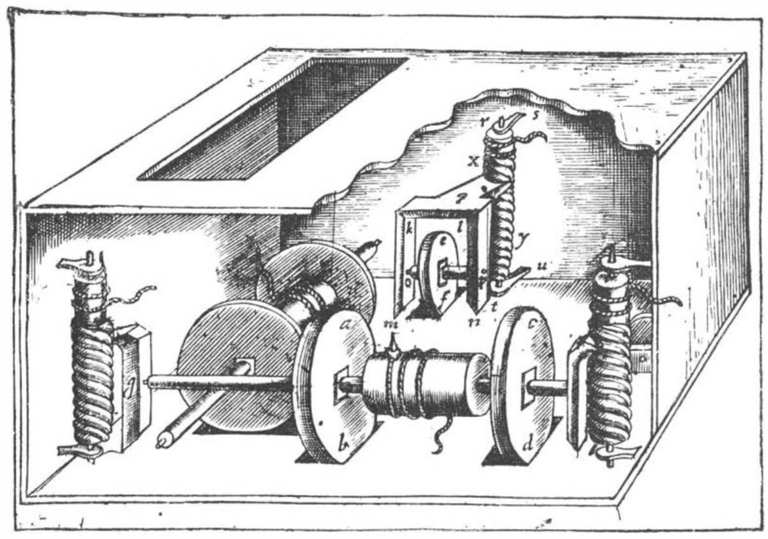


Fig. 5.

Hero also shows how the shrine can be constructed to move in straight lines at right angles to each other. Fig. 4 shows the arrangement of the wheels for this purpose, and Fig. 5 is a perspective view, showing the

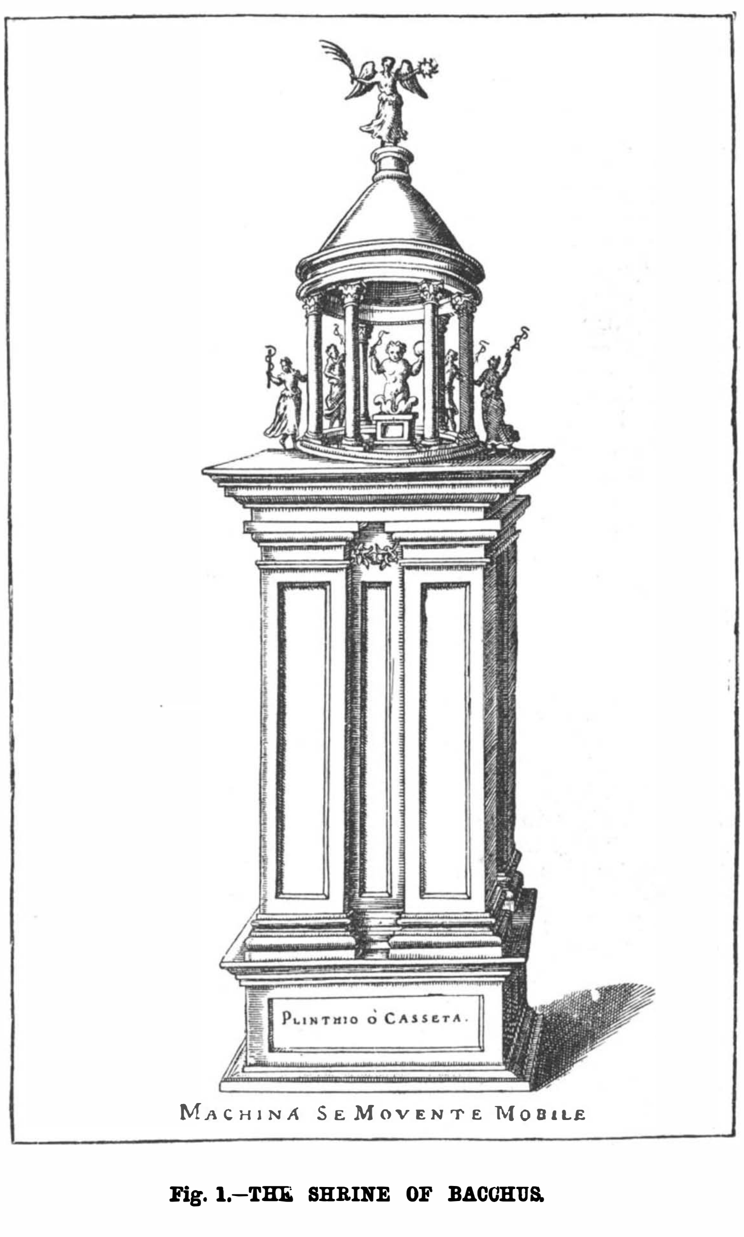


Fig. 1.—THE SHRINE OF BACCHUS.

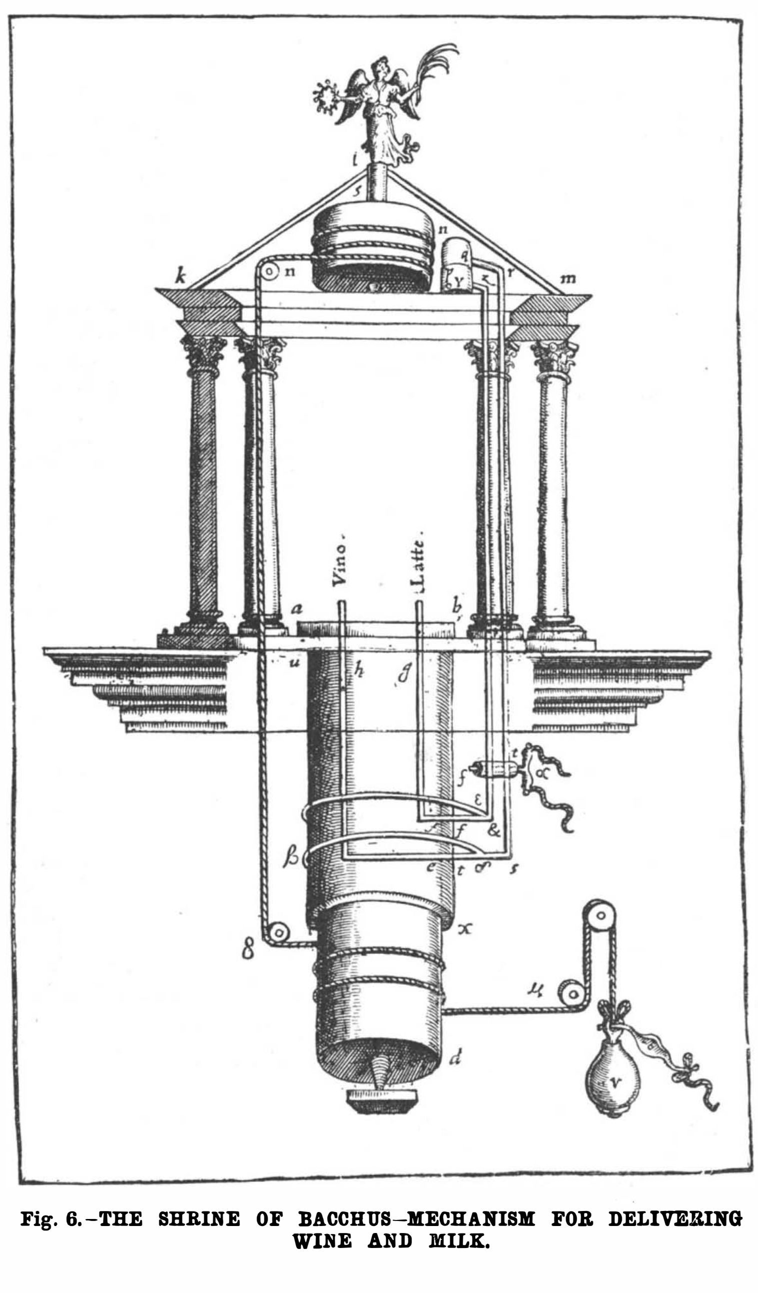
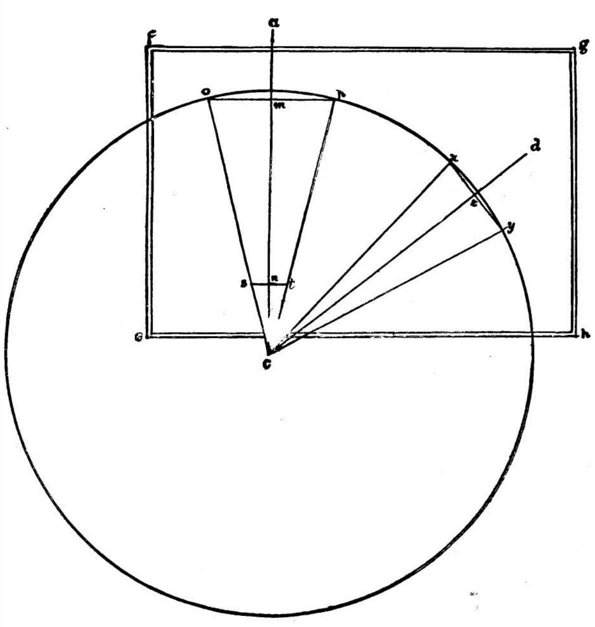


Fig. 6.—THE SHRINE OF BACCHUS—MECHANISM FOR DELIVERING WINE AND MILK.

screws by which the bearings of either set of wheels could be raised or lowered, so as to cause the shrine to move in the way proposed.

Fig. 6 shows machinery adapted to the shrine by which, on turning the figure of Victory at its top, two fountains beneath its canopy could be made to discharge wine or milk at pleasure. This apparatus is an adaptation of the two-way cock, whose plug, seen at

Fig. 5.



d, is turned by the enwrapping cord as shown. The milk was contained in the vessel, y, and the wine in q, and the two liquids pass down through one of the columns of the canopy, by the tubes, z r, and when the plug, d, is turned half around as described, the fountain jet that was discharging milk then flowed with wine, and milk took the place of wine in the other jet. The fountains were stopped by turning the duplex cock, f, and thus cutting off the supply of both liquids.

The mechanism of this shrine of Bacchus proves that 2,000 years ago the fact that wheeled vehicles could be propelled by power applied to the axles on which the driving wheels were fastened was well known, and that the mechanical principles involved in the application of the power were well understood. Furthermore, the shrine affords evidence of a high degree of refinement in mechanical manipulation in the cylindrical plug two-way cock, as well as in the general arrangement of the details of apparatus for performing the seeming miracle of changing wine into milk or milk into wine.

It is confidently believed that this is the first time this self-moving vehicle (which the shrine certainly was) of Hero has been described or even referred to by any writer in the English language. This is not strange, for the work of Hero descriptive of automata is very scarce, and the translations of Commandine into Latin and of Baldi into Italian are also rare.

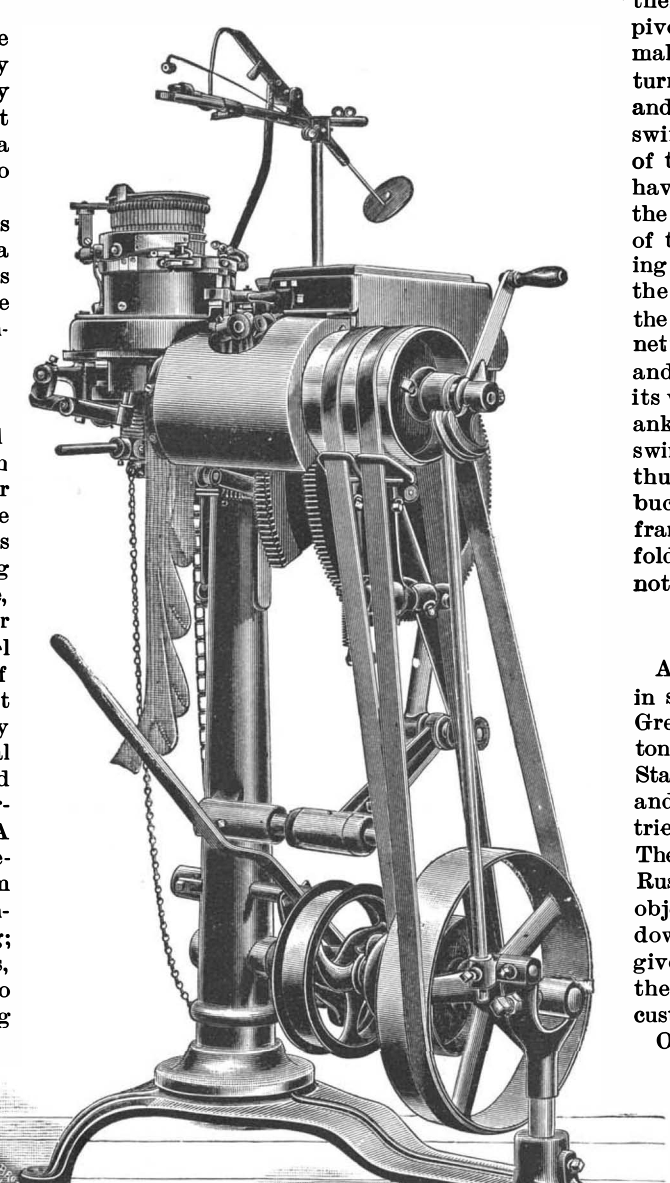
It is universally admitted by writers on mechanics that Hero is the author of the first description of a machine actuated by steam; but hitherto no one has claimed for him the honor—to which the evidence above submitted clearly entitles him—of having invented the first self-moving carriage or locomotive.

SOME NEW AMERICAN KNITTING MACHINES.

For some five or six years past Messrs. Scott & Williams, of Philadelphia, have been perfecting a system of automatic seamless hosiery machinery, and their latest improvements in this line are embodied in the machine shown in the accompanying illustration. Its chief characteristic is the mechanism for controlling the needles during the knitting of the heel and toe, involving first the gradual diminution of the number of needles of the group or series upon which the heel or toe is to be formed, one needle being thrown out of action, then another, and so on until the narrowest portion is reached, whereupon needles are gradually returned to action, in like manner, until the original number are once more in action. The device embodied in the machine is constructed on a principle which permits the needles alone to control its movements. A frictionally mounted ring is carried in suitable guideways at or near the upper edge of the revoluble cam ring, and this ring is free to turn or to be stopped independent of the movement imparted to the cam ring; upon this ring are mounted two levers termed pickers, the inner ends of which extend inward far enough to engage the butts of the needles, their outer ends being under the control of a pivoted lever carrying segmental plates. One of these pickers is poised at or near the middle of its length and has its inner end recessed or stepped; the other slides bodily in suitable guideways. Assuming that one-half or thereabout of the whole number of needles in the head are thrown out of action, the direct moving picker is brought into contact with the butt of the first needle of the inactive set and stopped or arrested thereby, and while so arrested an upward thrust is imparted to it by the lifting lever, whereby it is not only itself raised, but, owing to the presence of the recess or step in its inner end, the needle is raised with it, and thus thrown out of action; another reciprocation of the machine carries this picker to the other side, where the same action takes place, and the first needle of that side is thrown out of action. This operation is continued until all necessary needles have been thrown out of action, whereupon the segmental plates carried by the lifting lever are moved, so that they engage with the poised picker, the under end of which travels in a path immediately above the butts of the inactive group of needles. The friction ring is still stopped by the first mentioned picker contacting with a needle butt, and the poised picker is brought into a position immediately over the butt of the first needle of the active set, and as its outer end is lifted by the lifting lever its inner end is depressed, which carries a needle with it. This takes place in like manner on the other side, and is continued until the heel or toe is completed. The needles are not subjected to the slightest side strain when being acted upon by the pickers, and the thrust is delivered in a direct line with the length of the needle. No changes of mechanism whatever are necessary in order to effect a change of gauge, and no derangement of parts can interfere with the correct and accurate operation of the needle-controlling members. At the beginning of the heel or toe the necessary needles are thrown out of action en masse by mechanism partaking of the nature of that above described for acting upon individual needles, in so far as the thrust is imparted in a line with the length of the needle, the mechanism for this purpose being of a most simple, ingenious, and substantial character. In order to insure the lowest possible percentage of "menders," circular courses are introduced between the joints of both heel and toe, the mechanism allowing the number of courses forming these gores to be increased or diminished at will. Either ladies' hose, men's half hose, or children's ribbed hose, or any combination of these types, are made with equal facility on the machine.

The machines of this firm are now in use among some of the leading concerns in this country, and in England and on the Continent of Europe, Messrs. Geo. Blackburn & Sons, of Nottingham, England, having been selected as builders for its distribution abroad, and the home plant being at the corner of Sixth and Arch Streets, Philadelphia.

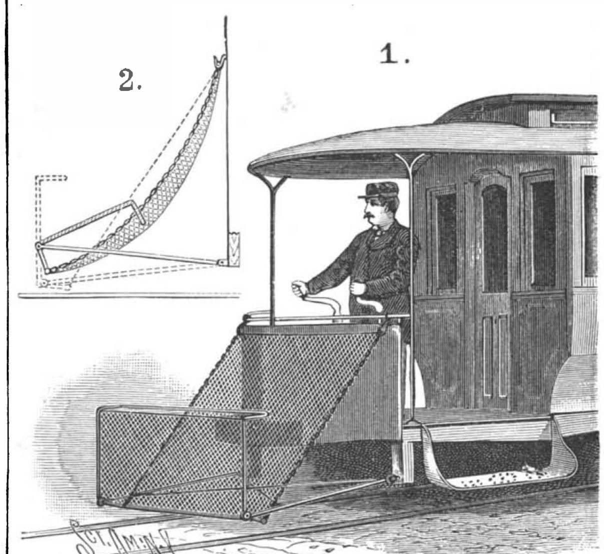
In a recent speech on the tariff bill Senator Quay said: "It is not an exaggeration to assert that the best knitting machinery in the whole world, for the manufacture of articles of wearing apparel consumed by the masses, is of American origin. So excellent is much of this machinery, and it is sold at a price so low, that there is a large and growing European demand for it. At this moment multitudes of American knitting machines, making hosiery of the lower grades, are being operated upon the Continent of Europe, and some of the best kinds of American machinery are built and sold in Europe by machine builders under agreement with American patentees."



SCOTT & WILLIAMS' IMPROVED AUTOMATIC SEAMLESS HOSIERY MACHINE.

AN IMPROVED STREET RAILWAY CAR FENDER.

The fender shown in the illustration is designed to be so flexible that it cannot possibly injure a person



EATON'S CAR FENDER.

whom it strikes, but will catch up such person in such way that he or she will be carried safely along with the car until the latter may be stopped. The improvement has been patented by Mr. Henry W. Eaton, of No. 45 William Street, New York City. Fig. 1 shows the device in use, Fig. 2 being a side view, representing the position of the parts when a person has been caught on the fender. A forwardly extending lower framework is connected by a hinge joint to the car, and chains extend from the forward end of the frame to hooks at either side of the dashboard. The chains are connected by a netting, and are only indirectly connected with the lower frame, being attached at their outer ends to the arms of a swinging frame pivoted to the lower frame, and which extends normally upward, as shown in Fig. 1, this frame when turned over, as shown in Fig. 2, striking the chains and network to depress them near the center, and swing them and the frame up slightly at the front end of the fender. The lower arms of the swinging frame have at their free ends a cross bar extending beneath the sides of the lower frame, limiting the upward swing of the arms and the outward movement of the swinging frame. The first effect of striking a person is to cause the upright frame to yield gradually, so as to break the force of the blow, and at the same moment the network, engaging the legs tightly between the knees and the ankles, relieves the body of much, if not all, of its weight and prevents the danger of breakage of the ankles by sudden shock. The vertical frame then swings inward under the weight of the falling body thus thrown upon the two nettings, the side chains buckling and raising the lower portion of the fender frame at its outer end. The whole device may be folded up in small space on the end of the car when not in use.

The Alaska Boundary.

A part of the expedition which has been engaged in surveying the boundary between the property of Great Britain and Alaska has returned to Washington. The joint survey of the boundary by the United States and Great Britain is now practically complete, and the State Departments of the respective countries may begin work at once on the conflicting claims. The greater portion of the region purchased from Russia is definitely located on the 141st meridian. The object of the English is said to be to force the line down to cross some of the broad inlets which would give them water access to their own territory, so that they would be entirely independent of United States custom regulations.

One of the interesting facts established by the expedition was that Mount St. Elias is not on United States territory, and that it must give precedence in regard to height to three mountains further inland, which all stand in British possessions. The height of Mount St. Elias as determined by this year's party is 18,023 feet, while Mount Logan is 19,534 feet high. The other two peaks are nameless as yet. There were no lives lost in the expedition and the trip was regarded as being very satisfactory.

Correspondence.

A Remarkable Dog.

To the Editor of the SCIENTIFIC AMERICAN:

A peculiar incident occurred to my fox terrier Fritz, which may be of interest to the readers of your valuable paper. On last Tuesday, while the cellar door was open, the dog descended in search of rats, at about 9 o'clock. At 9:30 the dog was searched for and thought lost. No further notice was taken in the matter until Wednesday morning at 11 o'clock, when I was attracted by a dog yelping. After a careful search in the cellar, which revealed only a pile of sand by the wall, I noticed the dog's nose protruding through an inch board at the top window of the cellar looking into the yard. I went immediately upstairs and removed five bricks from the pavement and pulled the dog out. After a careful inspection I discovered he had dug under the foundation of the house in the sand, which had caved in on him. Finding no other means of escape, he dug up to the surface, a distance of six feet; and on arriving at the brick surface, which had been recently paved, dug toward the window a distance of three feet, and had nearly eaten through the board in his efforts to free himself. He was nearly exhausted when discovered, being 26 hours under ground. One eye was entirely closed from sand, the other nearly so. The same dog recently jumped from the second story window, a distance of 18 feet, only injuring his toe nail. W. H. ROSE, Cornell 1897.

246 W. Hoffman Street, Baltimore, Md.

Cold Storage.

Experimental attempts at cold storage began in this city eighteen years ago, and developed into a commercial industry three years later. Since then the knowledge of scientists and inventors has been combined with the practical experience and capital of warehousemen, until now the business of cold storage and freezing is a considerale factor in the market supply of the world. At first the cold air from refrigerators on the ground floor was forced to storerooms above, but this plan was soon given up for the system, still in limited use, of massing ice at the top of buildings, so that a current of cold air is drawn by gravity through shafts to the lower floors. By this system only cold storage at 38° and above is possible, while actual freezing is necessary for many classes of goods. One of the nine large cold storage warehouses in this city uses a system of metal pipes ten inches in diameter, which encircle storage rooms. These begin below the "charging floor," the upper story of the building. Here ice is broken by hand power, the sectional trap doors are lifted, and the pipes, set close beside each other and extending down to the floors below, are closely packed with ice and salt. The drainage from these, which is collected on the second floor, is utilized to cool rooms on the ground floor to a temperature of 40° degrees. This method of cold storage is especially adapted for holding comparatively small amounts of perishable goods, without the cost of expensive machinery.

The system most generally in use, however, is that of producing intense cold by the evaporation of ammonia, and one of the largest and best equipped cold warehouses uses the so-called "direct expansion" system, which it is not necessary here to explain. In this immense establishment, which comprises in two warehouses 1,500,000 cubic feet of cold storage and freezing space, eight boilers, each of seventy-five horse power, are used in the smaller building alone. The engines, compressors, and all parts of the machinery are in duplicate, so that if one set is disabled the other set of machinery may be started and the requisite temperature throughout the building steadily maintained. Whatever the method used, the effect aimed at is the reverse of steam heating, that is to grasp and carry heat out of the rooms which it is desired to refrigerate. The brine which is produced by the ammoniacal gas process, and conveyed throughout the buildings in main pipes and smaller coils, leaves the manufacturing room in the basement at zero and returns from the circuit only 5° higher. All this apparatus in specially constructed buildings costs money, and at the present time more than $4,000,000 are invested in cold storage in this city alone.

The first floor of these great buildings is usually occupied by offices and open space necessary for receiving and discharging goods, and the storage floors above are reached by heavy freight elevators. Passing through a small anteroom on leaving the elevator, the "bulkhead," or thick wall, which is air spaced and padded so as to be as nearly as possible a non-conductor of heat, is reached. The heavy door swings open, and a change of 50° to 70° is realized in a second of time. The purity of the atmosphere and the uniform temperature of each room or "box" are evident. Tiers of goods extend to the ceiling, closely packed along immense floor spaces, or in smaller lots in separated rooms. To the visitor, who, as well as the guide, is protected with heavy wraps, the long stretches of pipes and rafters covered with frost crystals glittering in the electric light present a strange and beautiful spectacle. Poultry, meats, fish, butter, and eggs are stored in largest quantity, and actual experiments show that these usually perishable goods can be held in cold storage almost indefinitely, and meat and fish frozen and kept for five years have come out in good, marketable condition.

By this preservative process a glut is prevented in periods of too plentiful supply, the season for perishable goods is lengthened to extend the year through, and prices are equalized, to the profit of both producer and consumer. For example, yearling turkeys, which last February were stored and frozen, and since kept in a dry air at ten to fifteen degrees, are now the choice delicacy offered in the best hotels, and bring in the markets three cents a pound more than the best spring turkeys. But even in this favoring market there is not much profit to the merchant, since a third of a cent per pound is charged for the cold storage of poultry a month, and the higher rate of half a cent a pound each month for freezing. The prices charged for storage are, however, nearly fifty per cent lower than they were ten, or even five, years ago.

The vegetable and fruit supply of this district has been strikingly influenced by cold storage. Peas, lima beans, lettuce, okra, celery, and other seasonable vegetables are at this time stored by wholesale merchants for a few days or a week to hold steady a variable supply. Large quantities of domestic pears are also being carried on short-term storage. Considering the oversupply of California fruit now reaching this city, it is at first a surprise that none of it is being held for higher prices, but this is because the summer varieties, which alone are now coming, cannot be safely held, even in the cold dry air of these warehouses. Tokay and other grapes of vinifera blood later in the season are successfully held for three weeks, and Cornichons have been kept for six weeks and even two months. The more delicate varieties of grapes from this State and Ohio remain in good condition for several months, until the supply is exhausted by Thanksgiving season. The tough-skinned Catawbas, however, are brought out of an atmsphere of about 35° as late as April, when even the Almeria season is past. Domestic pears come from the refrigerating houses until midwinter, and some California pears, notably P. Barry, are kept successfully and profitably as late as June. Instances of large profit in carrying these pears are often cited. For example, lots stored in September, when they sold for $1.98 a box, commanded $8 a box nine months later.

Late spring varieties of Florida oranges often yield the largest profits of this crop, and are known to have quadrupled in value by July. In fact, oranges can be kept almost indefinitely, although they are rarely held more than sixty days without deteriorating somewhat in quality.

Horseradish, stored last spring when it cost three to four cents a pound, is now selling as high as ten cents, and buckwheat flour, after having been carefully cooled and kept against all objectionable intruders during the summer months, will soon be selling to eager buyers as the first new buckwheat of this year. Dried fruits and nuts are similarly protected during the warm weather, and seed corn and peas are kept in a freezing temperature to prevent sprouting and to destroy weevils. Owing to an abundance of cabbage last year, quantites of sauerkraut were stored, and this has proved a lucky venture on account of the failure of this season's cabbage crop.

These artificial low temperatures, besides their uses in arresting the decay and retarding the maturity of fruits and vegetables, are applied to other purposes connected with horticulture. Nursery stock has been kept in a cool temperature in good condition for three years, with the roots plump and ready for growing when taken out. Hardy plants which are intended for forcing are often frozen after they are lifted, so as to give them their needed experience of a winter, after which they will push forward with healthy energy. Imported pips of lily of the valley are largely held in cold storage, not only to preserve them, but because they start more quickly and strongly after having been frozen. Bermuda lily bulbs and other stock of this sort are also treated successfully in this way.

Refrigerator cars have made it possible to transport California fruit to New York, and some of the freezing processes on shipboard have been so perfected that perishable fruit can soon be sent all over the world. Unsound fruit cannot be saved by cold storage, but it can be kept in good condition if it is sound and not too ripe when first placed there. Cold warehouses in fruit districts have been advocated for storing the products of a neighborhood, so that they can be held for shipping until a time when the demand would make it profitable. To a certain extent this is practicable; but, as a rule, it is not safe to ship fruits after they have been a long time chilled, and, in a majority of cases, it seems preferable to transport the fruit directly from the orchard or the vineyard to its destined market, and then, after carefully selecting and packing that which is not overripe, to hold it until the time of demand. Many of the grape growers of this State will ship directly from their vineyards a part of their crop this year to be refrigerated in this city. It is claimed that the fruit keeps better when treated in this way than when it is stored in cold houses at home and shipped to this city afterward.—M. B. C., Garden and Forest.

Notes on the Handling of Petroleum.

A paper read before the Institution of Civil Engineers in London deals with the transportation of crude petroleum in bulk, from the point of view of minimizing the risks of fire and explosion, by Mr. Boverton Redwood. The subject was discussed in reference to transportation by tank steamships, but much of what was said applies with equal force to the transportation of this highly inflammable substance by tank cars. Experience has taught that the danger of explosion while handling petroleum lies not so much in directly igniting the oil as in igniting the inflammable and explosive mixtures of petroleum vapor and air.

The author of the paper alluded to stated that certain descriptions of petroleum evaporate freely at common temperatures; that the vapor given off is much heavier than air, and remains for a considerable length of time in any receptacle capable of holding a liquid, or may flow unperceived for some distance in a stream similar to that of a liquid; that the vapor is highly inflammable, and capable of carrying back flame to the source whence it emanates; and that mixtures of petroleum vapor and air may be either inflammable (burning silently) or more or less violently explosive. It was further shown that petroleum, at temperatures below that at which vapor is freely evolved, may be converted into a highly combustible spray. Crude petroleum consists of a great number of hydrocarbons, some of which are exceedingly volatile, and the vapor given off may be from 2½ to 3½ times heavier than air, its density depending upon the chemical composition of the hydrocarbons present. From the vapor density the volume of vapor given may be calculated, and it was thus found that one volume of a petroleum spirit consisting principally of hexane yielded 187 volumes of vapor at 60° Fah. The percentage volume of the vapor of a volatile hydrocarbon taken up by air depends upon the tension of the vapor, and varies with the temperature. When the vapor of petroleum is brought inte contact with air, diffusion takes place, the heavy vapor traveling upward into the lighter air, and the air passing downward into the vapor.

Referring to the conditions under which an explosive mixture of petoleum vapor and air may be ignited, it was stated that neither the glowing end of an ordinary wooden match or of a "fixed star" vesuvian, the flame of which has been extinguished, nor a redhot coal which has ceased to blaze, nor a shower of sparks from a flint and steel, or from the fireworks known as "scintellettes" and "golden rain," is capable of causing the combustion of the mixture; but a platinum wire raised to white heat by means of electricity invariably causes ignition, though at a red heat no such effect is produced. Either the electric spark, or a flame, at once causes the explosion of such a mixture, but an inflammable mixture containing a small proportion of vapor may be ignited by a large flame, when a small flame or an electric spark proves ineffective for the purpose. The use in an oil tank of a heated rivet at a temperature below that which is requisite for the ignition of a mixture of petroleum vapor and air may nevertheless be attended with danger, owing to the ignition of the oil which remains between the plates at the laps.

So long as the cargo tanks are full of oil there is very little risk of fire or explosion, except through serious structural damage resulting from collision or other accident. The accumulation of vapor due to leakage of oil from the tank domes of the oil tanks must, however, be guarded against, and care must be taken that these do not become overfilled or empty in consequence of increase or diminution in the volume of the oil.

Smoking and the use of matches about tanks filled with petroleum should be prohibited. The chief risk occurs during loading and discharging, and the precaution just named should then be zealously enforced. The tank covers should be kept closed as much as possible, and in the case of crude petroleum provision must be made for the safe discharge of vapor during loading. Before the tanks are entered for inspection they should be ventilated, and if repairs necessitating the use of hot rivets are to be effected, the oil compartments and adjacent spaces should be thoroughly cleansed and efficiently ventilated by a steam jet or fan blower, until on testing by a competent expert the complete removal of inflammable vapor is found to be accomplished.

Proportion of Solids in Milk.

According to A. Schmid, chemist to the Swiss Canton Thurgau (Chem. Zeit.), in 76 per cent of the samples of milk examined the total solids exceeded 12·5 per cent; in 20 it ranged from 12·5 to 12; and in 4 only did it fall below 12 per cent. Hence it appears that the demand of 12 per cent solids (and 3 per cent fat) as a minimum is not exorbitant. According to the same journal, 12 per cent solids, including 3 per cent fat, is the minimum permissible in Basle city.

THE UNITED STATES WAR SHIP ATLANTA RAMMING A DERELICT.

A prominent feature in the construction of all modern war ships, as is well understood, is the ram prow, for use in the sinking of opposing vessels in actual warfare. With this purpose in view, the stem or ram proper projects some distance forward below the water line, and is made exceptionally strong, being also strongly braced and supported in the forward compartments of the vessel. The utility of such construction for the purpose designed received a partial illustration in the ramming, on August 4, of a derelict, or floating wreck, by the United States war ship Atlanta, which forms the subject of the spirited illustration on our first page. The vessel rammed, the Golden Rule, floating at random in regularly traversed waters, was a danger to commerce, and on this account Captain Bartlett, of the Atlanta, determined to destroy her. The captain says: "We were steaming along at a fair rate of speed when the officer on watch sighted the derelict vessel. We speeded up and struck the wreck about amidships, going through her like cutting through cheese." The wreck, however, although thus cut in two, was not entirely sunk, having been very light and high out of water, her cargo having been empty barrels, but her capacity for inflicting damage on other vessels must have been greatly lessened. It was at first erroneously reported that the Atlanta herself had been seriously damaged, but on this point Captain Bartlett says:

"As is customary after ramming, we made a careful examination of the whole ship, including our engines, and it was discovered that the key in the crank shaft of the high pressure engine was loose, and was within an eighth of an inch of falling off. We immediately stopped the engines. If we had run ten—yes, perhaps five—minutes longer the crank would have slipped off. We then shut off the high pressure ports and made for Newport with the low pressure engine."

A recent report from the Naval Hydrographic Office affords some interesting information as to the large number of dangerous derelicts on the ocean. During the seven years 1887 to 1893 the office received 5,024 reports concerning a total number of 1,628 derelicts, of which number 482 were identified and 1,146 unidentified. The average number of derelicts constantly afloat is estimated to be 232 annually, or about 19 per month. Statistics compiled from the reports received show that the average period a derelict is afloat after having been abandoned is about thirty days. The dangerous character of these derelicts is illustrated by the fact that in this period of seven years there have been forty-five collisions with them, which caused the total loss of nine vessels and considerably damaged seventeen others. Seventy derelicts have been destroyed, one by torpedoes and the ram of the United States steamer San Francisco and sixty-nine by fire. Seven other attempts to destroy derelicts by fire are considered to have been unsuccessful, as the derelicts remained afloat for some time after having been set on fire. Five of these seven had cargoes of lumber that had become so waterlogged as not to be inflammable; the other two were in ballast. In the cases of the sixty-nine attempts regarded as successful the fact that these derelicts were never seen subsequent to the time they were set on fire is regarded as sufficient proof of their destruction.

The best known of all derelicts upon the ocean seems to be the schooner Fannie E. Wolston, abandoned October 15, 1891, and since reported forty-four times. She has been a derelict 1,025 days, during which she has drifted 8,575 miles, and is supposed to be afloat yet.

Photographing the Effects of Telephone Vibrations.

A correspondent of the Manchester Guardian has written to that paper:

"The problem has been attacked in a new way by Mr. G. J. Burch, who has succeeded in making an instrument by means of which the E.M.F. of the currents generated by speaking into a telephone can be recorded photographically. These currents are too rapid to affect an ordinary galvanometer individually, and inasmuch as they flow alternately in opposite directions, their combined effect is nil. But it seems that the capillary electrometer, invented some years ago by Lippmann, has been brought to such perfection in Oxford that electrical changes occurring hundreds, and even thousands, of times in a second can be recorded by its means. The instrument consists of two glass tubes, one drawn out to a fine point and the other bent into the shape of the letter V. The latter is about half filled with mercury, and contains in one limb a few drops of dilute sulphuric acid. Mercury is poured into the other tube, and is forced, partly by its weight and partly by compressed air, into the narrow part of it, where it hangs balanced, as it were, by the force of capillarity. This tube is fixed so that its point dips into the acid in the V-tube. Platinum wires dipping into the mercury in either tube serve to connect the instrument with the circuit of the telephone.

"The smallest change in the electrical condition of the circuit instantly disturbs the balance of the capillary forces, and the end of the mercury column is driven up or down, according as the pressure of the current is toward it or away from it. These movements occur with a rapidity that the eye is unable to follow, and the instrument is perfectly dead-beat in its action —i. e., there is nothing at all resembling the oscillations of the needle, which render observations with a sensitive galvanometer so serious. In order to record these movements recourse is had to photography. The magnified image of the capillary tube is projected on to a screen in which is a narrow slit. Behind the slit a sensitized plate is made to pass with a perfectly regular motion, any rise or fall of the mercury column being recorded as a projection or a notch on the edge of its shadow. This method was introduced by Prof. Burdon Sanderson. The apparatus now employed was invented by Mr. Burch. The first photograph shown was taken seven years ago. The electrometer was connected with a telephone, near which a whistle was blown. The currents generated were so intense as to cause electrolysis, and it was evident that the movements of the electrometer had been too rapid to be properly recorded on the photograph. This led to the construction of the present apparatus, in which the plate can be made to travel at any desired rate from 6 inches to 6 feet per second.

"The next illustration was obtained by singing a falsetto note near the telephone, the electrometer having responded to the currents generated by each vibration to the number of 650 per second. From this result it was evident that the apparatus might be used for studying the sounds of the human voice in speech. The syllables 'pop-pop-pop-pop' and 'dod-od-od-od,' spoken during the passage of a plate, produced results easily distinguishable from each other and evidently characteristic of these consonants. The vowels 'a' and 'e' formed the subject of the next two photographs, and the last represented the buzzing sound of 'Z-z-z-z.' This gave a very irregular curve, and Mr. Burch stated that with the lens fine serrations could be distinguished which corresponded to from 2,500 to 3,000 double vibrations per second."

Professor Helmholtz.

Professor Herman Ludwig Ferdinand Helmholtz, the eminent physiologist and physicist, died in Berlin September 8, from the effects of a stroke of paralysis. Professor Helmholtz was one of the foremost scientists of the century, and by his invention of the ophthalmoscope he may be regarded as a benefactor of mankind. Like Tyndall, it was not the least of Helmholtz's glory that he succeeded in popularizing the special branches of science to which he had devoted himself. Helmholtz was born August 31, 1821, at Potsdam, where his father was professor in the gymnasium. He entered the University of Berlin in his seventeenth year, and after receiving the degree of doctor of medicine at the Frederick William Institute, he became a surgeon in the Charity Hospital of Berlin and later a military surgeon at Potsdam. Medical education at the time when young Helmholtz studied was essentially a study of books, but the young student soon saw the disadvantages of the system, and a large part of his life was devoted to ameliorate these conditions. The value of the study of medicine was well expressed by Helmholtz in later life when he said: "Apart from the fact that I entered on the study of medicine at a period when any one who was even moderately skilled in physical modes of examination found a fruitful soil to cultivate, I consider the study of medicine to have been the school which taught me, as no other could have done, the eternal laws which are the bases of all scientific work."

After occupying various positions in several German universities, he was appointed in 1871 to the chair of physics in the University of Berlin. In 1887 Professor Helmholtz was invited to preside over the physico-technical institution in Berlin, founded chiefly by Dr. Werner Siemens. He accepted the call, but still retained until his death the position of professor ordinarius in the university. In 1883 the German Emperor conferred on Herr Helmholtz and his family the honor of hereditary nobility.

The greatest achievement of Helmholtz was the invention of the ophthalmoscope or eye mirror in 1851, by which the interior of the eye may be examined. This invention, which is one of the crowning achievements of the nineteenth century, has saved the eyesight of thousands. The result of his investigations was published in 1856 in a remarkable work entitled "Manual of Physiological Optics." After the ophthalmoscope, his most important work was done in acoustics and acoustic physiology. When at the University of Bonn he invented a method of analyzing sounds by the use of resonators. His great work, entitled "The Doctrine of Tone Sensations as a Physiological Basis of the Theory of Music," was published while he was professor of physiology at Heidelberg. His other works and the many papers which he contributed to scientific journals and learned societies are too numerous for mention here. Those who wish to know more of the life and works of the great scientist are referred to the SCIENTIFIC AMERICAN SUPPLEMENT 823, which contains an interesting biographical sketch by one of his pupils, Hugo Kronecker. The visit of Helmholtz to the Fair last year will be remembered by all. To-day Berlin mourns over the loss of two of her sons who died within a few days of each other. Helmholtz and Brugsch have both done much to make the learning and the educational institutions of Germany at once the wonder and envy of the world.

Coffeeism.

The evil effects of coffee on many constitutions are matters well known. Many a case of persistent pruritus has been made to disappear by simply interdicting the use of coffee. On the other hand, coffee, taken without milk and with but little sugar, exercises the most beneficial influence in many cases of migraine, especially if a little lemon or lime juice is added to the decoction. Some weeks before his death the late Professor Charcot was in attendance upon a family composed of the father, mother, and six children, who had become the victims of an uncontrollable mental irritability upon the least provocation. Hardly a meal passed at the family board without an explosion. Upon the least pretext the father became furious, the mother scolded, and the children would give way to hysterical crying. The family were all hypochondriacal. The strangest part of the history consisted in the fact that domestics employed and residing in the family would soon partake of the general cachexia and join in the pandemonium.

In the middle ages, this house would have been considered haunted, and somebody would have been burned, or hung and quartered as having enchanted the premises. This was the nineteenth century, however, and as demons, goblins, fairies and vampires are no longer the fact, Charcot looked into the hygiene of the locality for a solution of the difficulties. On investigation he found that the father was a manufacturer and a dealer in coffee; the roasting, grinding, and packing, as well as the manufacturing of the essence and of the extract of coffee, being carried on in the lower floors of the premises. In the apartments above the odor of coffee permeated every nook; the furniture and clothing smelt strongly of coffee. The inmates were suffering from chronic coffeeism. A few weeks' residence in the purer air of the seashore and change of habitation soon brought about a change for the better.—Pacific Med. Jour.

The Secondary Products of Combustion.

A statement has been communicated by M. Iloswa to the Bulletin de la Societe Chemique de Paris respecting certain determinations made by him of the formation of secondary products containing nitrogen by combustion in air. The author considers he has proved that, on burning in air one and the same volume of coal gas and of hydrogen, one and the same weight of nitrogen is converted into ammonia. On burning equal volumes of coal gas and of hydrogen, the nitrogen transformed into nitrous acid will also have approximately the same weight. But on burning carbon monoxide, nearly 2½ times more nitrogen is found in the state of nitrous acid than in the former case. Supposing one kilogramme of each of these gases to be burnt, the most nitrogen in the state of ammonia, and in the state of nitrous and nitric acids, is found in the product of the combustion of hydrogen; only one-fourth of the quantity being found in the case of coal gas, and about one-twentieth in the case of burning carbon monoxide. On burning wood charcoal in air, whether merely dried or heated to redness, the quantity of nitrogen contained in the nitrous and nitric acids collected is almost equal to that of the product. There is not much difference in the result of burning an equal weight of coke. The formation of ammonia during the combustion of coke or charcoal is merely a result of the decomposition of these substances. Otherwise it would be difficult to understand why the weight of the ammonia formed should vary according to the degeee of heat. On burning coal gas and hydrogen, the sum of the equivalents of the acids named is from 11 to 15 times greater than the figures of the equivalents of the ammonia. M. Iloswa remarks that hydrogen peroxide is one of the constant components of the atmosphere, and almost always accomplishes the reactions commonly attributed to ozone. He gives up as impossible the determination of atmospheric ozone upon a scientific basis.

Wood Pavement in London.

The new Tower Bridge is paved with the wood of the eucalyptus tree, from Australia. The blocks are about the size of building bricks, and their top surface has beveled edges, thus affording horses a foothold. They are fastened together by means of pegs put through them and fitted into corresponding holes in the adjoining blocks. This wood is a dark, mahogany color, is very expensive, but heavy and durable. It was laid according to the Duffy patent system with special machinery by J. Temperley & Co., of London. Wood is replacing stone pavement in many of the London streets; but in them it is laid in a simpler and less costly manner.

Cotton Wool in the Nostrils.

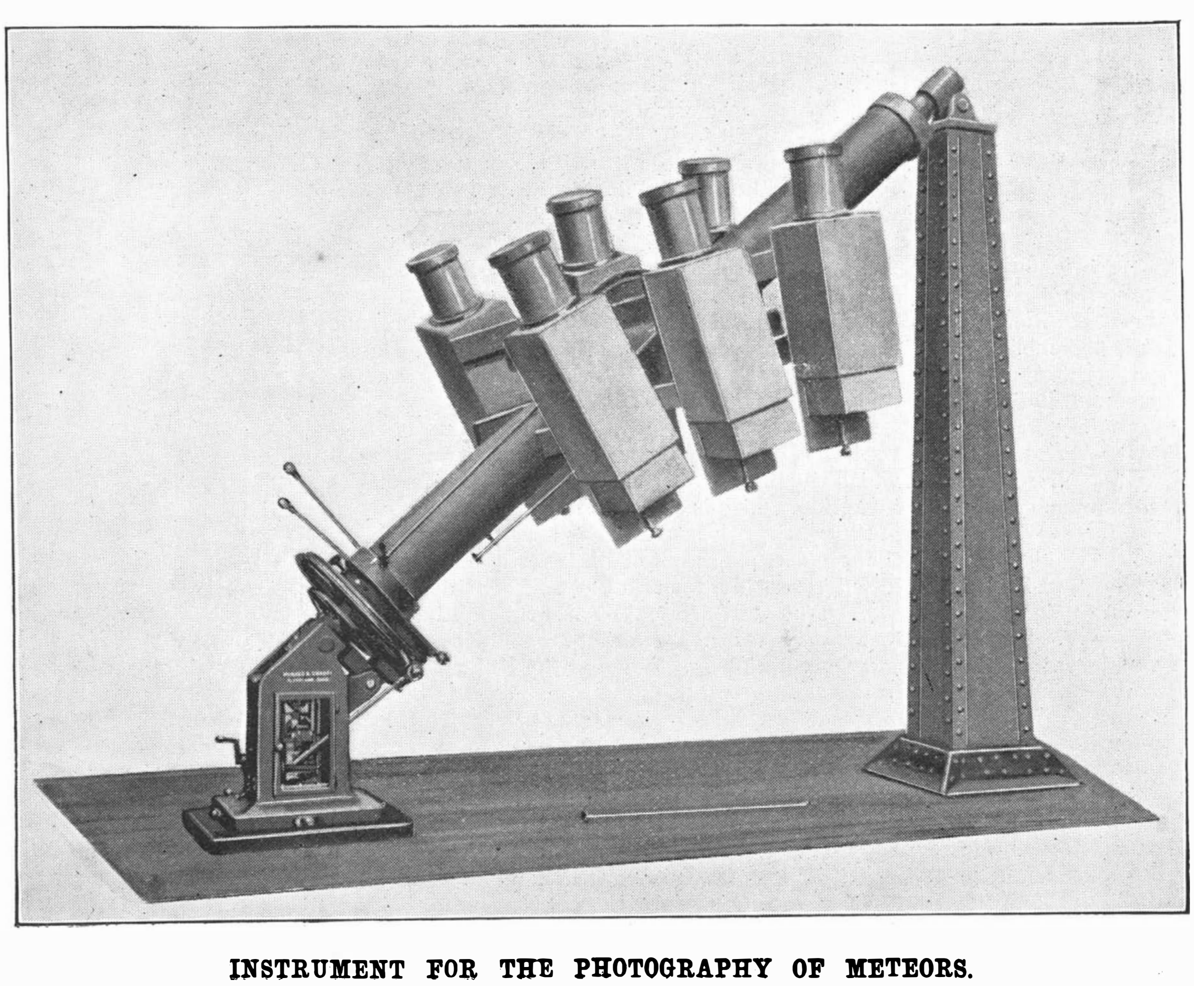
F. P. Mann, M.D., San Francisco, in the Pacific Medical Journal, writes as follows: Everybody is acquainted with the fact that nature has attempted to guard the portals of respiration through the nose by placing just within the nostrils of man or air-breathing animals a multitude of hairs. These act as a very imperfect strainer in arresting the portion of the dust and germinal matter with which the air we breathe is laden. It would also appear from somewhat extended observation and experiment that individuals whose nostrils are best supplied with hirsute growth are less susceptible to the irritating qualities of foreign material so universally distributed through the atmosphere, to say nothing of septic matter from decomposing animal and vegetable substance, bacteria, the special bacilli of various diseases, etc. Abundant experiment long ago demonstrated that cotton wool was capable of arresting germinal matter with which the air is filled. By placing within the nostrils out of sight a thin pledget of cotton not sufficiently dense to interfere with free inspiration, the air may be greatly purified. The cotton immediately becomes moistened during expiration, which adds materially to its efficiency as a filter. That thus placed it will arrest dust, particles of soot, etc., may be easily shown by introducing the pledgets and then after an hour's walk through the streets removing them, when they will be found blackened and soiled. Microscopic examination discloses quite a zoological museum of germinal matter. Prominent among the displays are found various forms of catarrhal and bronchial secretion that have been desiccated and pulverized by passing feet, thus liberating the germs which planted upon a congenial soil will produce catarrh to order.

It is not generally known that a certain variety of penicillium glaucum which often develops upon clothing stowed away in trunks or closets where dampness prevails will produce violent symptoms of influenza whenever such fungus infected articles are handled. Professor Credi, of Naples, asserts from careful observation that fifteen grains of dust from the streets of that city contains hundreds of thousands of microbic germs. Are the streets of American cities any freer from germinal matter? It is claimed for the film of cotton that it catches and holds in its meshes germinal matter. Any germs that succeed in passing through the filter are arrested by the moisture which it maintains in the anterior nares. It is probable it offers more or less perfect protection to those exposed to infectious and contagious diseases.

INSTRUMENT FOR THE PHOTOGRAPHY OF METEORS FOR THE YALE OBSERVATORY.

W. L. ELKIN.

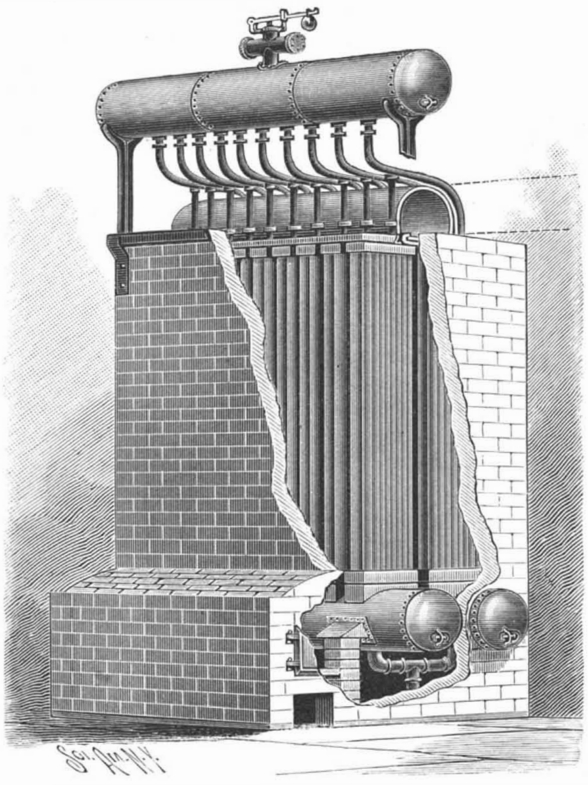
The experiments made at this observatory last year seemed to show that, if a sufficiently large field could be covered, it might be possible to secure quite a number of meteor tracks on photographic plates, during the August and December showers, at least. The incomparably greater accuracy, as against eye observations, with which these tracks locate the meteor and the radiant, has led us to consider the matter worth following up, and accordingly application was made to the National Academy for an appropriation from the Lawrence Smith fund which is to be devoted to meteoric researches From the grant awarded us the instrument represented in the cut has been constructed by Messrs. Warner & Swazey. It is a polar axis of the English form, this seeming to be the most convenient and the best adapted mounting for carrying a number of cameras, and admitting of long exposures without break. The axis is of tubular form, about 12 feet long, the ends being pivots working in bearings which are adjustable on their supports. The southern support, or base, contains the clockwork, the northern support is a column containing the driving weights, the connection being made by a cord passing under the floor. The declination axis carries arms on either end which serve as supports for the cameras. On the cut six dummy cameras are shown; it is not likely for the present, however, that we shall use more than four. Graduated aids and slow motions for both co-ordinates are provided, and the clockwork has an electric control. The apparatus is now mounted here, and will be tried on the Perseids this year.—Popular Astronomy.



INSTRUMENT FOR THE PHOTOGRAPHY OF METEORS.

AN IMPROVED TUBULAR BOILER.

The boiler shown in the illustration is specially designed to economically produce dry or superheated



ALFONSO'S TUBULAR BOILER.

steam, and is provided with simple means for regulating the draught. It has been patented by Mr. Crecencio Alfonso, of Ranchuelo, Cuba. The furnace is at one side, and the boiler, consisting primarily of twin heaters, is supported on pillars by V-shaped flange extensions, which may be hollow and filled with water to protect them from injury by heat. A common feed pipe, with branches, supplies both heaters from below, and also serves as a brace. Casings on the upper side of the heaters have steam-tight connection with vertical water tubes in parallel rows, the upper ends of the tubes being secured to boxes forming chambers, and the water preferably covering the upper ends of the tubes, yet not entirely filling the chambers in practical operation. A steam tube from each of the boxes extends up to a steam dome, the tubes being adjacent to and a portion of them partially surrounding the smoke flue. The products of combustion from the furnace rise in contact with the heaters and tubes through a central passage communicating with the smoke flue, there being in this passage a number of apertures adapted to be partly or altogether closed by a sliding damper moved longitudinally in guides. Further information relative to this improvement may be obtained of Mr. D. Luis Casañas, Ranchuelo, via Cienfuegos, Cuba.

Return of Dr. Cook's Arctic Party.

The ill-fated steamer Miranda left New York July 7, with Dr. F. A. Cook, of Brooklyn, and a party of scientists and sportsmen who desired to visit the coasts of Labrador and Greenland.

Among the party, which numbered about fifty, were William H. Brewer, professor of agriculture, Yale University; C. Fred Wright, of Oberlin College; Professor B. C. Jillson, Professor G. W. Dove, of Andover; L. L. Dysche, professor of zoology, Kansas State University; Professor Charles E. Hite, of the University of Pennsylvania; Professor Elias B. Lyon, of Chicago; and Professor A. A. Freeman, of Andover. The Miranda was to cruise around Newfoundland, cross Davis' Strait to the west coast of Greenland, then to Melville Bay and visit the winter quarters of Lieutenant Peary. The return was to be made by way of the coasts of Greenland and Labrador; and New York was to be reached about September 15. A series of accidents befell the Miranda. On July 17 she collided with an iceberg near the Straits of Belle Isle. The vessel returned to St. John's, Newfoundland, for repairs, and on July 27 a second attempt was made to reach Greenland. The progress of the Miranda was impeded by fogs and ice, so that she did not make harbor at Sukker Toppan, Greenland, latitude 65:20, until August 7. She started for Holstenborg August 9, and struck a sunken rock outside the harbor of Sukker Toppan. The damage was so severe that it was not considered safe to return to St. John's in the Miranda. Dr. Cook and a portion of the party set out for Holstenborg, 140 miles away, in an open sail boat, and secured the fishing schooner Rigel, of Gloucester, Mass., to transport the party to St. John's. The Miranda then started with the Rigel in tow, but on August 21, while 300 miles out, the water tank of the steamer was burst by the heavy swell, and on August 23, Captain Farrell abandoned his vessel. Ninety-one persons were now crowded in the little schooner of 107 tons burden. Only two meals a day were allowed. The passage was rendered doubly disagreeable by bad weather. At last the party arrived at North Sydney, Cape Breton, on September 5. Most of the passengers returned home by rail. Nearly all of the baggage, including natural history specimens and negatives, was lost. The escape of the party was fortunate and one of its members, Mr. J. D. Dewell, of New Haven, evidently voiced the feelings of the majority of the party when he telegraphed to his friends: "Out of the jaws of death."

The Effect of Sulphur in Cast Iron.

In a recently issued volume of the Proceedings of the Institution of Civil Engineers there is an abstract of a paper on the above subject by Mr. W. J. Keep. The author has for six years been trying to verify the received belief that sulphur is in every way injurious to cast iron; and he has made numerous experiments with artificially sulphurized cast iron up to 2 per cent of sulphur, both gray and white, the results of which are recorded in the paper. The conclusion finally reached is that the proportion of sulphur retained by gray cast iron cannot materially injure the iron, except by increase in shrinkage, which in the extreme ends seems to be from 0·168 inch to 0·194 inch per foot. The general testimony is that most of the sulphur present in pig iron is lost in remelting, and that it is impossible it can be reabsorbed to any damaging extent from the fuel. The influence of sulphur is diminished by increase of carbon or silicon. In wrought iron, which is practically free from these elements, a small amount of sulphur is said to do great harm; and such iron will take up sulphur in considerable quantity. The influence of sulphur on all cast iron is to drive out carbon and silicon, to increase shrinkage, and in general to reduce strength; but in practice sulphur will not enter the iron in the foundry to a sufficient extent to realize these defects.

PARASITES ON A CATERPILLAR.

The accompanying illustration represents one of the green sphinx caterpillars so frequently found feeding upon the leaves of wild cherry trees, grapevines, etc. The specimen in question, however, is greatly burdened with a large number of egg-shaped cocoons of a parasitic insect, an ichneumon fly, the cocoons sticking out of the caterpillar's skin the same as bristles on a round brush.

This parasitic insect, on maturing in its shell, bursts the upper end thereof, crawls out, and then sails forth on its own wings. The minute ichneumon flies lay their tiny eggs in the skin of the caterpillar, and from these eggs hatch the larvæ, which live within and get their nourishment from the caterpillar.

The caterpillars infested by these parasites die before attaining maturity; but if healthy caterpillars that are not burdened with the parasitic cocoons be found, it is possible to obtain a pupa or chrysalis which, when properly kept, will change the following year to a moth belonging to the sphinx or hawk moths, which in the morning and evening twilight dart swiftly from flower to flower in search of honey as their food.

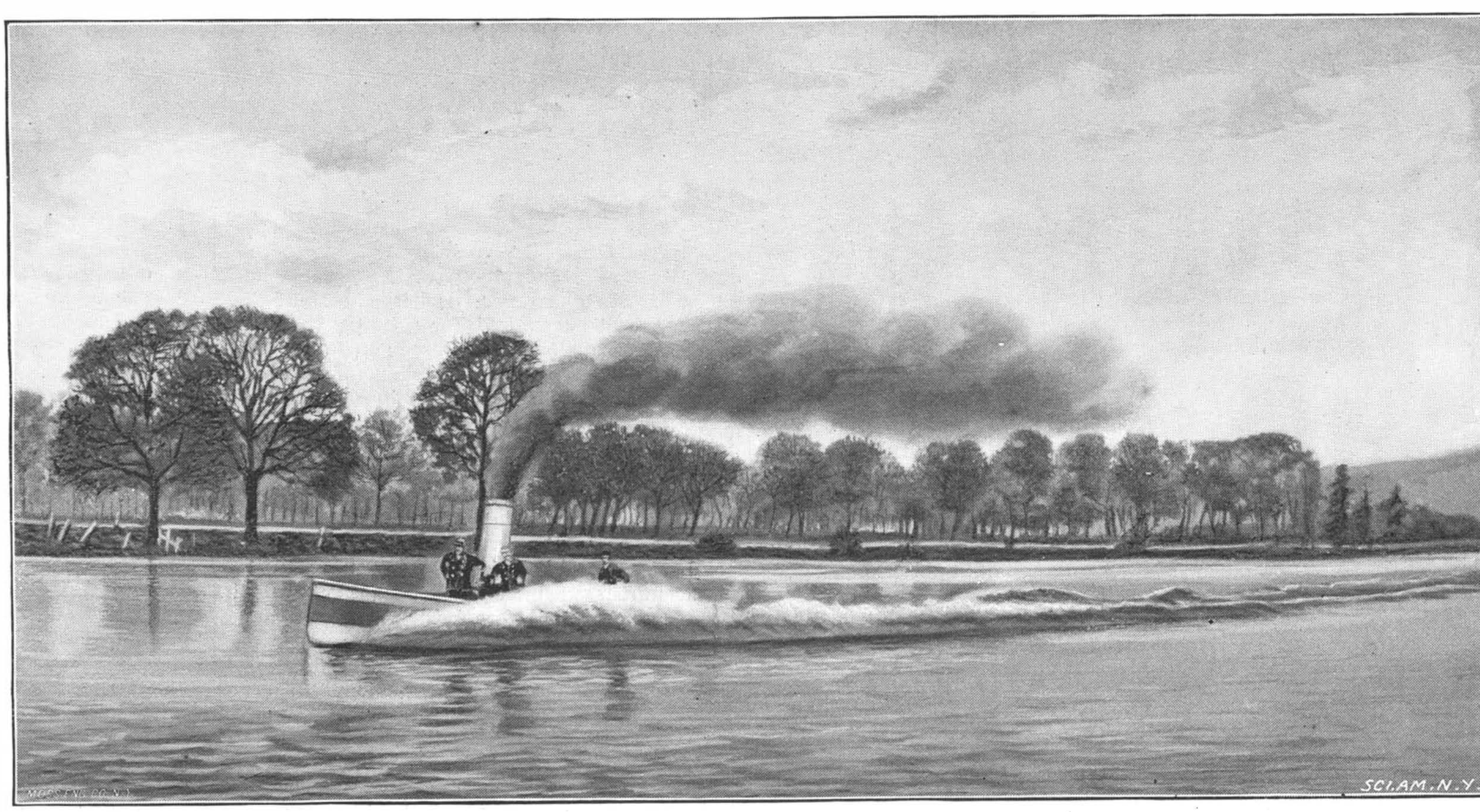
PARASITES ON A CATERPILLAR.

On Manganese Steel.

Manganese steel (13 per cent of manganese) is not magnetic, and of all the alloys of iron it is the one which presents the highest electric resistance. It is the more malleable the more energetically it has been tempered. There is a second allotropic variety which is magnetic. M. Le Chatelier has determined the conditions of the transformation of the two varieties of manganese steel into each other. To convert the non-magnetic into the magnetic metal it is heated to 550 degrees from one to two hours. To convert the magnetic metal into the non-magnetic metal it is heated to 800 degrees and cooled rapidly, so that the inverse change may not be produced between 500 degrees and 600 degrees. The expansion of the two varietes of manganese steel has been found alike which excludes the existence of a change of dimension at the point of transformation. Manganese steel tempered in water on reheating undergoes a contraction of 0·4 mm. in 100 mm.—H. Le Chatelier.

THE HIBERNIA—A FAST STEAM LAUNCH.

Our engraving, for which we are indebted to the Engineer, London, represents the Hibernia, a boat built and engined from the designs of Mr. G. F. G. De Vignes, by Messrs. Simpson & Strickland, at Teddington. It is, we believe, the fastest boat of its size afloat, and a trip in it is an experience. At ordinary speeds the Hibernia behaves like an ordinary boat, cutting her way through the water and leaving a moderate impression in the form of shore waves. With a slight touch of the regulator she leaps forward, and as the speed increases, she gradually sinks a little by the stern, rises a little at the head, until at a certain high speed the bow rises clean out of the water, and the boat flies along at the top of it, throwing a double wall of spray, between which she flies at a speed of about 29 miles an hour with the stream and 26¼ miles against the stream, as measured and remeasured at Mousley. There is but little chance of making these speed trials, and very great risk in making them in this part of the river, for among other difficulties which arise are the objections which owners of house boats urge against having their boats lifted up on the banks and left there. Some idea of the power of this boat, which is the property of Mr. R. H. Lebat, of Hampton Wick, may be gathered from the following statement of dimensions and engine power: The length of the boat is 48 feet 3 inches over all; breadth, 7 feet 3½ inches; draught, 1 foot 4½ inches; and depth of propeller below the water line, 2 feet 5 inches. The boiler is of steel, locomotive pattern, with barrel five-sixteenths inch thick, quintuple riveted in longitudinal seams. The engines are two-cylinder, both high pressure, 7⅛ inch diameter, stroke 6 inches, revolutions about 750 per minute up to 1,050 revolutions per minute when doing the highest speed. The propeller has three blades of hammered double shear steel, with carefully prepared surface and knife edge, keyed in a wrought steel boss and accurately balanced. The engines are of small dimensions, except in the wearing and hard working parts, and here the dimensions are very large, and at first glance disproportionately strong. Every detail has been most carefully designed, and carried out with equally careful workmanship and excellent finish. The boat was built for Mr. Lebat chiefly for umpire work at regattas and coaching university crews, and it began coaching for the last races within an hour of steam being first raised. From that time to about three weeks ago the boat ran over 3,300 miles without the touch of a spanner. We have never seen a finer piece of work than these little engines, and Mr. Lebat is to be congratulated on the high quality and performance of both engines and boat.



THE HIBERNIA—A FAST STEAM LAUNCH.

Slate—How it is Mined.

The manner in which slate is mined and cut up for purposes to which it is applied is a process that is known to only a few people in this country, its principal sources being in upper New England and eastern Pennsylvania. It is not taken out of shafts, but it is quarried out of big holes in the earth. Some time ago, when the writer was at Bangor, Pa., he was invited to go down into one of these quarries, about 200 feet deep, and overhand on a rope, but he declined the invitation, as I think most inexperienced persons would do. The slate is blasted out in huge blocks and is hoisted out by steam and turned over to the men who know how to reduce it to the proper size. Huge blocks of it are taken in hand by these workmen, who cut a notch into one end of each piece. Then they take a chisel and a mallet, and they are so skillful in directing their blows that they can split the blocks of slate in almost any way they please. If you watch the slab on which one of them is working, you will see a little hair line running through it, and presently the block will fall apart on either side of this mark. The workman will make this line go straight through the middle, or to either corner, just as he likes. I do not know just how he does it, but he invariably accomplishes what he sets out to do. The smaller pieces thus produced are taken in hand by another set of men, who split them up into sheets of the proper thickness for roofing slate. This they do with a long-bladed instrument about the shape of a putty knife, but many times larger, and if you saw them do it, you would marvel how they got the sheets only inch thick and split it thirty-two times. The usual number of divisions is sixteen. These sheets are taken and cut into squares by machinery.

Wherever there are slate quarries you will find a great many Welshmen, for the best slaters come from Wales. Boys follow the trade of their fathers, and there are whole familes and settlements who know no other means of earning a living.—New York Advertiser.

Aluminum Shoe Nails.

On the late visit of Prince Bismarck to the Emperor, the latter called the attention of the ex-Chancellor to the improvements made in the boots of the Prussian infantry. This consisted in the displacement of the old fashioned steel nails by nails from aluminum, which is much lighter and more durable. The extra weight under the sole of the foot imposed by the heavy nails formerly worn, and the added weight consequent upon the clogging mud in nasty weather, made a great and needless extra amount of muscular expenditure necessary. The new arrangement will permit of longer and better marching, with fresher troops at the end of the day.

[FROM THE MOUNT LOWE ECHO.]

Telescopic Wonders of the Moon.

BY PROF. LEWIS SWIFT.

When we view the moon with a powerful telescope and see her extensive plains and mountain chains, her extensive shore lines and dry ocean beds, her thousands of volcanic craters and their central cones, it is difficult to realize that we are gazing into another world brought by the powers of the telescope, that marvelous instrument, to a distance of a few hundred miles, as it were almost within our grasp. Strange as it may seem, we are more familiar with her mountains than with those of our own world. On this side of the moon, though 240,000 miles away, there is not a mountain whose height has not been measured, nor a crater whose diameter and depth is unknown. The brevity of this paper forbids detailment of the process resorted to accomplish so improbable a feat, though at some future time I may revert to the subject of celestial measurements.

Save a few chains of mountains the scenery of the moon is totally unlike that of the earth.

The naked eye sees the moon flecked with dark patches which by the exercise of fancy become "The Man in the Moon." But, it is needless to say, there is no "man" there nor life of any sort. The dark, naked eye portions were, before the invention of the telescope, looked upon as mares or seas, and names then given them are still retained, as, for instance, Mare Nubium, Mare Crisium, Mare Tranquillitatis, etc. But the telescope has shown beyond doubt that they were once ocean beds, with their shore lines still plainly visible, which, when the moon was young, were lashed by her tidal waves, though now, on this side at least, not a single drop of water may be found. Because there is no waste in nature, and because from lack of contact with other bodies its water could not be conveyed away, the question arises, Whither has it gone? The moon in its cooling from circumference to center has absorbed it all, and a like fate awaits the earth itself in the coming ages.

Her atmosphere too has been absorbed, though she, doubtless, once was thus enveloped. When our planet too shall have cooled to its center, a process slowly going on, it will have absorbed all of its water and air and will thirst for more. Though alike in this, and in both being solid globes, the earth and moon have little or nothing else in common.

To her mountains we have given the names of the mountain systems of our world, as the Alps, the Apennines, the Caucasus, etc., and their scenery consists largely of elevated rings surrounding deep cavities or craters of which the telescope reveals the existence of over one hundred thousand of all sizes, from those of a few rods to the largest (Shickard), 149 miles in diameter, and, in depth, from those of a few yards to the deepest (Newton) over four miles down. On all the earth there is not a true representative of a lunar crater, the nearest approach being that of the Mauna Loa volcano of the Sandwich Islands. The largest of them have, like the seas and mountains, been given names and bear the cognomens of distinguished men of science. The moon, indeed, seems to be a vast cemetery of dead philosophers. We find there Archimides, Aristotle, Copernicus, Gassendi, Herschel, Kepler, Newton, Plato, Ptolemy, Tycho, etc. To describe even the greater ones would transgress the space accorded me. Tycho, best seen when the moon is full, is visible with an opera glass. It is 49 miles in diameter and 3¼ miles deep. From its center rises a conical mountain as high as Mount Lowe. These rings, so prominent a feature of lunar scenery, are often surmounted by cathedral spires or "turrets" sometimes many thousand feet high, which cast long, black, tapering shadows on the flat bottoms of the "craters." In addition to the turrets, many small craters or "craterlets," with yawning chasms between, are seen on the tops of the rings.

Clavius is an enormous ring inclosing 16,500 square miles, in which are several craters, from one of which rises a conical mountain, 24,000 feet in perpendicular height.

The largest of them all, Shickard, so large, in fact, as almost to deserve to be called an immense plain, is 149 miles in diameter, and surrounded with a circular wall, in places ten thousand feet high, which incloses an area of almost twenty thousand square miles, to fill which three hundred Lake Eries would be needed. So immense is it, that were a person to stand at its center, his horizon would be above the ring and he could not be aware of his imprisonment in a well 10,000 feet deep, but would seem to himself to be standing on a level plain. On the flat bottom of this ring twenty-three craterlets have been counted.

Aristarchus is the most brilliant object on the moon and may be seen on the dark side before sunlight has reached it. It was this that Sir William Herschel announced as a volcano in action.

One mountain peak near the moon's limb rears its lofty crest 41,900 feet above the valley below, but this is less high than the highest mountain of the earth, as the depth of the valley must be deducted from its height.

Linne—this little crater has been more discussed than any other, because it is thought to furnish at least one instance of change. Some sixty years ago it was described as being 6½ miles in diameter, and so conspicuous as to be used by two astronomers as fundamental points of the scenery of the moon. In 1866 Schmidt announced that the creater appeared to be under a cloud, and, since then, only an exceedingly small crater is just visible where Linne was. This is the most reliable evidence which can be cited of change in any lunar object.

Lowe Observatory, Echo Mountain, July 20, 1894.

How Postage Stamps are Printed.

Uncle Sam is beginning to print his own postage stamps at the Bureau of Engraving and Printing. The wheels have started, and before many days the machines will be turning out the parallelograms of red, blue, and green paper at a rate to supply the Post Office Department with the required forty million sheets per annum. Each sheet, as furnished to the government, will consist of one hundred stamps. The printing is done on queer looking presses, each of which produces 1,600 stamps a minute, or about 100,000 an hour. Each press has an endless chain that carries four plates, on which the designs of the stamps are engraved. On each plate 400 stamps are represented. The sheets printed from these plates are intended to be cut into quarters eventually, in which shape they will be sold by the Post Office Department. Each plate is carried by the endless chain first under an ink roller, from which it receives a coating of ink of the proper color. Then it passes beneath a pad of canvas, which oscillates so as to rub the ink in. Next it pauses for a moment under the hands of a man who polishes the plate. Finally, a sheet of white paper is laid upon the plate, both pass under a roller, and the sheet comes out 400 printed postage stamps.

The plates revolve in a circle, as it were. More accurately speaking they move around the four sides of a square in a horizontal plane. While one is being inked, another is being rubbed by the canvas, another is being polished and the fourth is passing under the printing roller. The circuit takes about a minute, during which four sheets of 400 stamps each are printed. The most important part of the work, requiring the greatest skill, is the polishing. It is done with the bare hands, no other method being equally efficient. The object is to leave exactly enough ink for a good impression and no more. One girl lays the white paper sheets upon the plates, while another young woman removes them as fast as they are printed and stacks them up in a pile. This process gives the results of hand press work. Half a dozen presses working together, each turning out 100,000 an hour, can produce a good many millions in a day. Three hands are required for each press—the printer, who does the polishing, and two girls. The printer must account for every sheet of blank paper that he receives. The sheets are counted in the wetting division before they are delivered to him. After they are printed they are counted before they are sent to the examining division, where they are counted again. Spoiled sheets are counted as carefully as perfect ones, because they represent money. If lost or stolen, they could be used. On each sheet appears the special mark of the printer who turned it out. An allowance of one and a half per cent is made to him for spoilage. If he exceeds that allowance, he must pay for the extra loss at the actual cost of paper, ink and labor represented. This rule does not apply yet, for the presses are hardly adjusted, and hundreds of sheets have been spoiled in experiments.

If a sheet is lost, it must be traced back to the last person who handled it and that individual will be required to pay face value for the stamps represented. If the person responsible cannot be found, the division which last handled the sheet must pay. No loophole is left for the loss of a single one cent stamp. After being examined, the sheets are counted again and are put between strawboards under a hydraulic press to make them lie flat. Thus they are counted more easily and can be made up into smaller bundles. After undergoing this process they are counted once more and are sent down stairs to be gummed and perforated. For these purposes the Bureau of Engraving has purchased entirely new machinery, and the means employed are more than ordinarily interesting. The method of gumming in particular is a novelty, being wholly different from that utilized hitherto in such work. It is much more rapid and efficient, and before long will doubtless supersede the old plan, which is even now applied to the gumming of cigarette stamps for the internal revenue. The paste is applied to the cigarette stamp by hand with brushes. As fast as they are gummed they are laid sheet by sheet on slatted frames, which are piled in stacks. The stacks are wheeled on trucks into a room, where they are placed in front of electric fans, so that the cool air may dry them. Hot air would accomplish the purpose more quickly, but it would be hard on the workwomen. For this reason the slower process is adopted. The new method will be an immense improvement in every way.

The machines for this purpose have just been set up. There are two of them, exactly alike, and one will do for description. Imagine a wooden box nearly 60 feet long, 4 feet high, and 3 feet wide. From end to end runs what might be taken for the skeleton of a trough. This skeleton projects from the box for a few feet at either extremity. The box is traversed by two endless chains, running side by side two feet apart. Into one end the sheets of printed stamps are fed one by one. As it is fed into the machine each sheet passes under a roller like the roller of a printing press, to which a gum made of dextrine is slowly supplied. The sheet takes up a coat of this mucilage on its lower side and is carried on by the endless chain through the long box. The box is a hot air box, being heated by steam pipes. At the other end of it the sheets are delivered at the rate of eighteen a minute. Just one minute is required for a sheet to pass through the box, and it is delivered perfectly dry. The gummed sheets thus delivered are passed over to a long table, where girls pick them up in pairs, and placing the gummed sides together, put them between layers of strawboards. Arranged in this way they are placed under a steam press to flatten them, the mucilage having caused them to curl somewhat. On coming out of the press they are counted again, and now they go to the perforating machines, that make the pin holes by which it is easy to tear the stamps apart.

The perforating machine is an arrangement of little wheels revolving parallel to each other and just far enough apart to make the perforations as one sees them in a sheet of finished stamps fresh bought at the post office. After the perforations have been made across the sheet one way by one machine, the sheet must pass through a second machine for the cross perforations. In the middle of each machine is a knife which cuts the sheet in two, so that the sheet of 400 comes out of machine No. 1 in two sheets of 200 each, and these are divided into four sheets of 100 each by the second perforating machine. It is an old though not well authenticated story that when the British government wished to discover a way to tear stamps apart readily it offered $50,000 for an acceptable suggestion. A poverty stricken but ingenious Englishman proffered the notion of perforating the stamp sheets and received the fortune. The stamps are now done and only remain to be gone over, inspected, counted and tagged in packages of 100 sheets before being sent out. Each package of 100 sheets holds 10,000 stamps, of course. But stay! There are one or two more preliminaries yet. After receiving the perforations, the sheets of one hundred are put under a press to remove the "burrs" around the little holes, otherwise these would greatly increase the thickness of a package. Then they are counted and are placed in steel-clad vaults, from which they are drawn as the Post Office Department may want them. The Bureau of Engraving has not yet begun to furnish stamps to the government, but it is all ready to do so. In response to orders received from the Post Office Department, it will put the stamps up in packages, address them to postmasters who require them and deliver them at the Post Office in Washington for mailing.

The Post Office Department now has an agency at the Bureau of Engraving. When a postmaster wants stamps, he makes out a requisition up onthe department. The latter will communicate with its agent in the bureau, who will draw upon the bureau every day for as many stamps as he requires to fill the orders thus transmitted to him. All this business used to be done in New York City, where the stamp agent received the stamps from the American Bank Note Company in bulk, his business being to put them up in packages and send them off by mail. The inks used for printing the stamps are manufactured at the Bureau of Engraving. The materials are bought in the shape of dry colors and linseed oil. The colors come in the shape of powders. The only stamps turned out thus far are two cent red and the one cent blue. For the former carmine is employed, and for the latter ultramarine. Both colors are "toned" by the admixture of other ingredients—the carmine with Paris white and white lead. Pure carmine would be very costly. Ultramarine is not very expensive, but it is too "strong," in the printer's phrase—that is to say, too dark. It used to be the costliest of colors, being made from the precious lapis lazuli. But in recent years chemists, having analyzed the lapis lazuli, have produced in the laboratory a successful imitation of the color stuff. For making the ink the color powder is combined with linseed oil and ground between rollers. Each printer receives every morning his allowance of ink, and sharp account is kept of every bit used. Uncle Sam will save about $50,000 a year by printing his own postage stamps. Congress has given to the Bureau of Engraving $163,000 for this purpose for the fiscal year beginning July 1. Out of this appropriation some machinery must be bought. The expense used to be $208,000 per annum. Of course the government had nearly all of the required plant ready. About fifty new people have had to be engaged to do the extra work. The plates used by the American Bank Note Company for printing the stamps were the property of the government.—Rene Bache, Phil. Times.

MANUFACTURE OF BELT LACING.

Belt lace is used principally in manufactories for sewing machine belting. It is manufactured principally from the hides of cows and steers, the process which they pass through causing them to become soft, tough and pliable. As soon as the hides are removed from the carcasses of the steers they are salted and carted to the tanners or lace makers. They are then placed in water overnight and then brushed with a knife, the soaking and brushing process causing the removal of the salt, blood, and fat or grease. From the soaking tubs the hides pass into the lime pits, which are about 7 feet in depth and about 5 feet square, and are made of either wood or stone. These pits contain a solution composed of 1,000 gallons of water, about ½ bushel of lime, and about 10 pounds of sulphite of sodium. A pack of about 40 hides is lowered down into this solution by means of a piece of rope fastened to each hind shank, the end of the rope

MANUFACTURE OF BELT LACING.

being looped and passed over a wooden pin at each end of the pit. After soaking about 48 hours in this solution, which loosens the hair, the hides are drawn out and rinsed off with water to remove the lime, etc., and taken to the unhairing beam, where the operator scrapes off the hair with an instrument similar to a carpenter's drawknife. The hair from 50 to 60 hides can be scraped off daily by a good hand. After rinsing they are then fleshed. The under side of the skins or hides as they come from the slaughter houses have pieces of flesh adhering to them, which are removed by means of a knife on what is called a fleshing beam. These beams are oval shaped and made of hard wood. A hide is spread over this beam and the operator takes a sharp knife, cutting off the particles of flesh and also trimming the hide down to the veins, making it of an even thickness. A good hand can flesh about 60 hides per day.

The trimmings or particles of flesh are sold to glue manufacturers, bringing about 25 cents per bushel, the particles being kept from spoiling by means of a little lime added to them. The hides after fleshing are soaked for about two hours and then go through a tanning or drumming process. The drum in which the hides are tanned is circular in shape and made of cedar. It is 7 feet in height and 3¼ feet in width, and perforated with about 200 1 and 1¼ inch holes, through which and projecting out on the inside are the same number of wooden pins 4 inches in height. The tanning solution, which is composed of water, with 72 pounds of alum, 24 pounds of salt, and half pint of neat's foot oil, is put into the drum with from 10 to 12 hides, the drum being and then set in motion. The interior is then heated up to a temperature of about 100° (F.) by means of a steam pipe passing through the shaft in the center of the drum. The revolving of the drum causes the hides as they are carried upward to fall down against the pins, which forces the tanning solution through them. After revolving about one hour at the rate of 10 revolutions per minute, they are taken out and hung on to wooden horses to drain for several hours, and then they go through a second drumming with a similar solution for about 40 minutes. They are then run through water and allowed to drain and dry overnight. The hide when dry is very stiff, and has to be dampened before it is steaked. This is done by drawing the hide through water. The steaking machine is about 7 feet long, and consists of four upright pieces of oak 2½ feet in height and about 8 inches in width, two of which are bolted opposite each other to one end of a heavy piece of planking, and the other two pieces to the other end.

The uprights are about 6 inches apart. Fastened to the top of two of the uprights is a blunt knife, over which the attendant holds the hide. The leather is softened by the downward stroke of a circular oak bar, which is connected by means of a circular iron rod to the machinery above, the other end of the bar being pivoted between the other two uprights. When the bar strikes the hide it forces it over the knives and down between the uprights, the operator drawing it out with every upward stroke, placing it in position again to meet the downward stroke, which is continued until the whole hide is softened. The machine makes about seventy strokes per minute, steaking from four to five hides per hour. They are then dampened, the lumps, if any, taken off by a shaving process, and then slicked. The slickers are made of steel, stone, glass, the blades of which are about one-half inch in thickness, six inches in length, and about two inches in width, the bottom of the blade being flat. The hide is spread out on a marble table, the operator passing the slicker over it, the action of which smooths it out. Sixty hides can be slicked daily. It is then sponged over with neat's foot oil and hung up to dry. After drying it is cut up into lace. The hide is fastened to a hook at the end of the table and the cutting instrument gauged to the right width. The operator then forces the end of the knife blade through the hide, drawing it along the whole length. This operation is continued until the whole hide is cut up into lace. The strips of lace range from one-fourth inch to five-eighths inch in width and from five to ten feet in length. Forty to fifty strips of lace can be cut from a side. A good hand can cut forty sides into lace per day. The sketches were taken from the plant of F. Guenther, Newark, N. J.

Soft Coal Without Smoke.

Mr. C. M. Higginson, an expert Chicago engineer, in a paper on the abatement of the smoke nuisance, gave the following rules as essential to good combustion:

1. A good draught.
2. Open grate bars.
3. Means for supply of air above the fire.
4. Means for mixing the air with the volatile gases.
5. Distance in which to complete the combustion of the mixtures.

Mr. Higginson says the grate bars should have air spaces equal to fifty per cent of the grate, and that unrestricted space of 20 feet is needed for the flame. With an 18 foot boiler this can be secured. For locomotive boilers and tugboat boilers a combustion chamber should be placed midway between the tubes. In no case should the draught for the flame be direct from the fire box through the tubes, for the temperature in the tubes rarely rose above 320 degrees, and 1,500 degrees was requisite for the combustion of the volatile gases, which was the chemical character of smoke.

The Electro-Deposition of Cadmium.

Smee appears to have been one of the first—if not the first—to deposit cadmium. Since he published the results of his experiments the matter has received little attention, partly due, no doubt, to the scarcity and considerable cost of the metal; it can now be obtained of good quality at a low rate. Its use has hitherto been confined to the production of the yellow sulphide, CdS, as an artist's pigment, and to the aid of the photographer in the form of iodide, Cd I_2, and bromide, Cd Br_2. Cadmium melts at the same temperature as tin, an alloy of 3 parts cadmium, 15 bismuth, 8 lead, 4 tin, fuses at the remarkable temperature of 140° Fah., 72° below the boiling point of water, which has led to its being selected for the manufacture of fusible alloys for electric cut-outs. A cadmium amalgam, consisting of 78·26 parts mercury and 21·74 parts cadmium, agreeing with the formula, Hg_2 Cd, can be kneaded like wax at a moderate temperature, and was formerly used by dentists for stopping teeth. Cadmium resembles tin in color and appearance, and is very malleable and ductile at the ordinary temperature. The comparative hardness of cadmium to other plated metals is shown in the following table:

	Hardness.
Nickel electro plate	10·0
Sheffield plate	10·0
Antimony electro plate	9·0
Palladium (deposited bright)	8·0
Platinum electro plate	6·0
Cadmium silver alloy (Cd 60·5, Ag 39·5)	5·0
Cadmium (deposited bright)	4·5
Silver (burnished)	4·0

The figures represent the hardness as registered by the number of grammes weight on a diamond point required to produce a scratch.

Smee obtained good tough deposits of cadmium from an ammonia-sulphate solution, made by adding ammonia to the sulphate and dissolving the precipitate in a very small excess of the precipitant, but was unable to obtain good deposits from sulphate or chloride solutions.

In 1849, Messrs. Woolrich & Russell, of Birmingham, took out a patent for depositing cadmium; they prepared a solution by dissolving metallic cadmium in nitric acid of commerce, diluted with about six times its bulk of water, which they preferred to add at a temperature of some 80° or 100° Fah., adding the diluted acid by degrees till the cadmium was dissolved. To this solution of cadmium they added a solution of carbonate of soda (made by dissolving 1 pound of ordinary crystals in a gallon of water) until the cadmium was precipitated; the precipitate thus obtained was washed three or four times with tepid water, when it was ready for use, various solvents being used, but the one preferred was a solution of cyanide of cadmium, which was added in sufficient quantities to dissolve the precipitate and leave one-tenth of the solution in excess. The best working strength for the solution was found to be 6 ounces (troy) of the metal to the gallon, the temperature of the bath being about 80° or 120° Fah. Bertrand claims to have obtained white adherent coatings from an acid sulphate solution and a solution of the bromide slightly acidulated with sulphuric acid. Cowper-Coles also recommends a strong solution of the double salt of cyanide of cadmium and potassium, as it will deposit the metal rapidly, and in a bright form, a cadmium anode dissolving very freely. Its inertia to chemical action as compared to zinc and brass renders cadmium suitable for coating the terminals and connections of primary and secondary batteries, and for coating small shot (for sporting purposes) and steel bullet jackets, in the one case to prevent the leading of the barrels, in the other the corrosion of the steel. Within the last three years cadmium silver alloys, containing but a small percentage of silver, have been employed for coating the bright steel parts of machines, such as bicycles, and a silver cadmium alloy containing 7·5 per cent of cadmium has been somewhat extensively used for plating domestic articles. Such alloys have been found to withstand the tarnishing influences of the atmosphere much better than pure silver, or a standard silver containing 7·5 per cent of copper.

A silver cadmium alloy, upon being tested with a Thomson galvanometer, was found to be electro-positive to nickel, there being a difference of more than 0·25 E.M.F.; therefore if the alloy is used for coating steel, and the underlying metal is at any time exposed to a chance scratch or abrasion, the corroding action of the air and water is more violent in the presence of the nickel than in the presence of the silver cadmium alloy covering, owing to a more intense electrical action being set up by the nickel. Cowper-Coles' process for depositing the cadmium alloy consists of preparing the electrolyte by dissolving the cyanides of the two metals in cyanide of potassium, the proportions of the two metals being varied with the nature of the deposit sought. To obtain deposits of 10 to 80 per cent of cadmium, it is found necessary to have the ratio of the silver and cadmium in solution in the proportion of from one to four to one to seven, the best results being obtained when the amount of metal in solution is from 3 to 4 ounces per gallon, and the amount of silver per gallon not less than 8 dwts. or more than 25 dwts.; the weaker the solution, the smaller must be the current density employed, and in order to keep the bath from becoming exhausted the anode surface should be greater than the cathode surface, and sufficient free cyanide be always present in the bath to dissolve the cadmium cyanide formed on the anodes. The addition of the carbonates of the alkali metals is found to reduce local action, due most probably to the nascent liberated metal. As the nature of the deposit varies with the current density, attention to the color and general appearance of the deposit on a test plate or otherwise is found to give full control of the depositing process. An experienced plater can judge the composition of the alloy within 1 or 2 per cent, which is found to be near enough for practical purposes.—The Electrical Review, London.

On the Care and Cleaning of Object Glasses.

J. A. BRASHEAR.

So many possessors of telescopes write to me in regard to the care and cleaning of their object glasses that I think it will be of interest to the readers of Popular Astronomy if I give them the benefit of a long experience. There has always been such a halo thrown around the object glass of a telescope that those who own good glasses dread to touch them, and indeed this has partly been the fault of the makers themselves.

In an article on the care of the telescope in the May number of Popular Astronomy, copied from Mr. Gibson's handbook, there are some good suggestions, and some precautions; but I have more faith in any person who can use a telescope with ordinary intelligence than to say to him, "On no account should the two glasses composing the objective be separated or taken apart by the amateur;" on the contrary, I believe every one who owns and uses a telescope should be so familiar with his objective that he can take it apart and put it together just as well as the maker of it, and, as an objective must be taken apart after considerable use, particularly in moist climates, so as to clean between the lenses, I see no reason why the "amateur" or the professional should not be the person to do it.

The writer does not advise the use of either fine chamois skin, tissue paper, or an old soft silk handkerchief, nor any other such material to wipe the lenses, as is usually advised. It is not, however, these wiping materials that do the mischief, but the dust particles on the lenses, many of them perhaps of a silicious nature, which is always harder than optical glass, and as these particles attach themselves to the wiping material, they cut microscopic or greater scratches on the surfaces of the objective in the process of wiping.

I write this article with the hope of helping to solve this apparently difficult problem, but which in reality is very simple.

Let us commence by taking the object glass out of its cell. Take out the screws that hold the ring in place, and lift out the ring. Placing the fingers of both hands so as to grasp the objective on opposite sides, reverse the cell, and with the thumbs gently press the objective squarely out of the cell onto a book, block of wood or anything a little less in diameter than the objective, which has had a cushion of muslin or any soft substance laid upon it. One person can thus handle any objective up to 12 inches in diameter.

Before separating the lenses it should be carefully noted how they were put together with relation to the cell, and to one another, and if they are not marked, they should be marked on the edges conspicuously with a hard lead pencil, so that when separated they may be put together in the same way, and placed in the same relation to the cell. With only ordinary precaution this should be an easy matter.

Setting the objective on edge, the two lenses may be readily separated.

And now as to the cleaning of the lenses. I have, on rare occasions, found the inner surfaces of an object glass covered with a curious film, not caused directly by moisture, but by the apparent oxidation of the tinfoil used to keep the lenses apart.

A year or more ago a 7-inch objective made by Mr. Clark was brought to me to clean. It had evidently been sadly neglected. The inside of the lenses was covered with such a film as I have mentioned and I feared the glass was ruined. When taken apart it was found that the tinfoil had oxidized totally and had distributed itself all over the inner surfaces. I feared the result, but was delighted to find that nitric acid and a tuft of absorbent cotton cut all the deposit off, leaving no stains after having passed through a subsequent washing with soap and water.

I mention this as others may have a similar case to deal with.

For the ordinary cleaning of an objective let a suitably sized vessel, always a wooden one, be thoroughly cleaned with soap and water, then half filled with clean water about the same temperature as the glass. Slight differences of temperature are of no moment. Great differences are dangerous in large objectives.

I usually put a teaspoonful of ammonia in half a pail of water, and it is well to let a piece of washed "cheese cloth" lie in the pail, as then there is no danger if the lens slips away from the hand, and, by the way, every observatory, indeed every amateur owning a telescope, should have plenty of "cheese cloth" handy. It is cheap (about 3 cts. per yard) and is superior for wiping purposes to any "old soft silk handkerchief," chamois skin, etc. Before using it have it thoroughly washed with soap and water, then rinsed in clean water, dried and laid away in a box or other place where it can be kept clean. When you use a piece to clean an objective, throw it away. It is so cheap you can afford to do so.

If the lenses are very dirty or "dusty," a tuft of cotton or a camel's hair brush may be used to brush off the loose material before placing the lenses in the water, but no pressure other than the weight of the cotton or brush should be used. The writer prefers to use the palms of the hands with plenty of good soap on them to rub the surfaces, although the cheese cloth and the soap answers nicely, and there seems to be absolutely no danger of scratching when using the hands or the cheese cloth when plenty of water is used. Indeed, when I wish to wipe off the front surface of an objective in use, and the lens cannot well be taken out, I first dust off the gross particles and then use the cheese cloth with soap and water, and having gone over the surface gently with one piece of cheese cloth, throw it away and take another, perhaps a third one, and then when the dirt is, as it were, all lifted up from the surface, a piece of dry cheese cloth will finish the work, leaving a clean, brilliant surface, and no scratches of any kind.

In washing large objectives in water I generally use a "tub" and stand the lenses on their edges. When thoroughly washed they are taken out and laid on a bundle of cheese cloth and several pieces of the same used to dry them.

I think it best not to leave them drain dry. Better take up all moisture with the cloth, and vigorous rubbing will do no harm if the surfaces have no abrading material on them, and I have yet to injure a glass cleaned in this way.

The process may seem a rather long and tedious one, but it is not so in practice, and it pays.

In some places objectives must be frequently cleaned, not only because they become covered with an adherent dust, but because that dust produces so much diffused light in the field as to ruin some kinds of telescope work. Mr. Hale, of the Kenwood Observatory, tells me he cannot do any good prominence photography unless his objective has a clean surface. Indeed every observer of faint objects or delicate planetary markings knows full well the value of a dark field free from diffused light. The object glass maker uses his best efforts to produce the most perfect polish on his lenses, aside from the accuracy of the curves, both for high light value and freedom from diffused light in the field, and if the surfaces are allowed to become covered with dust, his good work counts for little.

If only the front surface needs cleaning, the method of cleaning with cheese cloth, soap and water, as described above, answers very well, but always throw away the first and, if necessary, the second cloth, then wipe dry with a third or fourth cloth; but if the surfaces all need cleaning, I know of no better method than that of taking the objective out of its cell—always using abundance of soap and water, and keep in a good humor.—Popular Astronomy.

Preservative Painting for Metals.

In a paper by Mr. M. P. Wood, read before the American Society of Mechanical Engineers, it is stated that graphite, mixed with pure boiled linseed oil to which a small percentage of litharge, red led, manganese, or other metallic salt has been added at the time of boiling to aid in its oxidation, forms a most effective paint for metallic surfaces, as well as for wood and fiber. Some recent experiments with this paint applied to the surface of boiler tubes show it to be very effective in preventing the formation of scale. Mr. Wood commends the system of requiring all iron and steel intended for structural uses to be pickled and cleansed from mill scale; declaring it to be an absolutely indispensable condition for all material of the kind intended to be preserved from rust by painting. It should then be painted two coats with pure raw linseed oil and red lead, after which the metal will stand the weather for fifty years without further treatment. Mr. Wood gives, for the benefit of engineers, a ready rule, deduced from his own experience, to determine the quantity of paint required to cover any structure. It is as follows: Divide the number of square feet of surface by 200; the quotient will be the number of gallons (American ?) of liquid paint required for two coats. Or: Divide the area in square feet by 18, and the result is the number of pounds of pure white lead required to give three coats, where this pigment is permissible. Red lead paint should be treated like Portland cement—applied to the work fresh, and allowed to take its initial set where it is to remain. A gallon of good red lead paint contains 5 lb. of oil and 18 lb. of red lead; and it will cover for a first coat about 500 square feet, and as a second coat about 600 square feet of surface.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Fred Kerlin, Columbia, Pa. With this coupling the cars couple automatically as they come together, and the uncoupling may be effected either from the top or the sides of the car, or by the engineer. The coupling pin is held in an upper position by a spring-seated pin which is removed from beneath the pin by the entrance of the link, allowing the pin to then drop through the link to couple the cars.

STREET CAR TRUCK.—Ferdinand E. Canda, New York City. A novel combination of an elliptic and a coiled spring, the one above the other, with other features of construction and arrangement of parts, are distinguishing features of this invention, which is designed to secure an easy spring movement, whether the car is running light or heavily loaded, and also allow a yielding lateral movement of the car axles and car body relatively to one another, thus avoiding shocks to the body of the car in rounding the sharp curves made in street railways. The weight of the car is also uniformly distributed to all the supporting springs.

Mechanical.

FILING BLOCK. — Edwin A. Brush, Hydesville, Cal. This is an improvement in blocks adapted to be held in a vise to support a wire or other article to be filed, the block being such as the vise will take a firm hold of, and having a finely adjustable slide plate to hold wires of many sizes, and form a substantial support for the wire. It is also adapted to form a perfect support for holding any flat, thin metal, to be filed, or for use in filing squares or as an anvil, while it may also be used as a templet.

CLAMP DEVICE.—John R. Hime, Sr., and Willis B. Cox, Savannah, Ga. This device comprises a yoke-shaped clamp member, formed preferably of wrought iron, through the eyes of which are passed an iron bolt or shaft, which also passes through and adjustably connects the clamp with a friction block. The device is adapted for use in repairing wharves, sheds, trestles, bridges, etc., and can be quickly and easily applied and used for joining such parts of the structure as need be drawn or held together.

STAVE CUTTING MACHINE.—William Nier, Kansas City, Mo. This is a continuously operating machine in which a revolving head block shaft and head block are journaled on a supporting frame carrying a reciprocating carrier holding a rotary form block with radially projecting adjustable cutters. The cutting knife and form block are automatically moved toward the block from which the stave is cut, there being means to reverse the operation automatically, and to insure the cutting of the staves the proper length and width. The machine is of simple and inexpensive construction, positive in its operation, and under the perfect control of the operator.

BARREL HEAD CUTTING MACHINE.—This is a further improvement of the same inventor, the machine comprising a main frame or table with rotary cutter passage, an upper cutter, a vertical rotary shaft having at its lower end a knife-carrying disk held just above the passage in the table, below which is held another vertical shaft having at its upper end a knife-carrying disk. A foot lever mechanism raises the lower shaft and cutter against the board to force it against the upper cutter. The machine is adjustable to cut heads of different thicknesses.

Electrical.

DISTRICT TELEGRAPH CALL.—William H. Garven, Portland, Oregon. In the call box, according to this invention, there is a cam on the winding shaft, and a slide bar adjusted by the cam according to the movement of the shaft, whereby a plate bearing pictorial illustrations of the different calls, as for messenger, police, fire department, carriage, express, etc., may be progressively brought to view, according to the throw of the winding shaft and cam. The call goes to the central office on two different circuits, is printed by different registers, and the box also notifies the party sending of the receipt of the call.

Miscellaneous.

STOVE FOR BURNING GAS.—Donald McDonald, Louisville, Ky. The burner of this stove consists of two tubes, one within the other, having registering perforations, the outer tube having a draught regulator to control the amount of pure air fed in between the two tubes, and the inner tube having a gas and air mixing device regulating the amount of air mixed with gas in the inner tube. The gas is burned in a perfectly air-tight chamber, with only so much air as is necessary to perfectly burn it, this air being furnished at exactly the right point, and the products of combustion being then utilized to heat the room before being sent up the chimney in a comparatively cool state.

PEN RACK.—Hiram D. Pierce, Cleveland, O. This is a combined rack and pen cleaner, an outer frame forming the rack proper, of open book-like construction and holding a series of leaves, meeting at the bottom but spread apart at the top to receive the pen between them.

HAME HOOK. — William W. Miller, Memphis, Tenn. This invention consists principally of a fixed plate having a hook and a pivoted lock plate having a tongue adapted to swing over the fixed plate hook to lock the trace ring or link in position. The hook is double, allowing the use of either hook at a time, and it is designed to securely hold the trace link or ring in place, without danger of accidental displacement, although the unhooking may be conveniently effected when desired.

PHOTOGRAPHIC TRAY ROCKING MACHINE. — Joseph Hess, Mifflintown, Pa. A rocking table top is, according to this invention, held in an open frame, pivot pins at opposite ends being journaled on the frame, and mechanism being provided for giving an oscillating motion to the top. The device affords efficient means for developing negatives or toning and fixing prints, allowing the operator the free use of his hands for inserting or removing plates or prints.

PHOTOGRAPHIC PRINT MOUNTER.—Harvey A. Lesure, Keene, N. H., and Delano D. Dunklee, Greenfield, Mass. This mounter has a base portion adapted to receive a photograph card in guides, whereby the card will come beneath a vertically movable platen provided with an absorbent pad, to take up moisture squeezed from the print, leaving the latter perfectly smooth and well stuck to its card, under an even pressure.

SHOULDER BRACE. — Walter Greenshields, Auckland, New Zealand. This is a device more especially designed for the use of women and children, to properly hold back the shoulders and expand the chest, giving also proper support to the back. It is composed of two similar elastic straps, with fastening devices, each strap being in the form of a loop to embrace the shoulders, and the extended ends being crossed at the back and meeting in front at about the waist.

TUBULAR KEY AND PNEUMATIC VALVE ACTION FOR ORGANS. — Peter Baggstrom, Brooklyn, N. Y. According to this invention the valve arrangement in the wind chest is so constructed that the valves may be manipulated by a light touch on the keys to produce a prompt speech from the tubes, the action being particularly advantageous for utilizing the coupling at present used between the several keyboards. The organ valve action is also so improved as to need no regulation, there being nothing in its structure to get out of order.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6225) T. H. writes: You will receive by mail an insect possessing features of a peculiar nature. By request I send it to you. It has what might be called a tail resembling a horse hair which it extends to a length of 4 inches at times and retracts it until it is scarcely perceptible. Nobody that has seen it ever saw anything like it, and it is sent with a view of hearing something about it from the SCIENTIFIC AMERICAN. A. The insect sent is one of our largest ichneumonids and is known scientifically as Thalessa atrata. In Insect Life you will find a full illustrated account of this insect. For this reply we are indebted to Dr. F. H. Chittenden, Acting Entomologist, Department Agriculture.

(6226) L. F. says: In my kitchen and the bathroom above are so-called cockroaches, a small black insect. Have tried all kinds of insect powder, but cannot drive them away. How can they be driven away? A. Borax is the best cockroach exterminator. The insect has a peculiar aversion to it, and it is said will never return where it has once been scattered. As the salt is harmless to human beings, it is much to be preferred to the poisonous substances commonly used.

(6227) W. H. C. says: Will you please explain to me through your paper why a glass or metal vessel filled with ice water and set in a hot room sweats? And also give me the best known definition of electricity? A. The name sweating is a misnomer, and should only apply to the issuance of moisture from the interior and its accumulation upon the surface, naturally from the skin and artificially from porous earthenware filled with water. The moisture and water upon the surface of ice pitchers or any cold article exposed to a warm, damp atmosphere is a condensation of the moisture in the air upon its surface by the cooling of a thin stratum of air in contact below the dew point, or the temperature at which the air becomes over-saturated, when the excess of moisture adheres to the cold surface, and in turn by further cooling makes a cold water surface in contact with the circulating air and thus accumulating the water of condensation until it no longer adheres, when it runs down in drops. The latest accepted theory as to the nature of electricity is that in all its phases or names it is only a varying condition of pulsations or wave motion similar to light pulsations having a greater length, but propagated at about the same velocity as light.

(6228) H. F. W. asks: 1. Does the velocity of a projectile shot from a firearm (either rifled or smooth bore) increase till the projectile has gone a certain distance from the firearm? A. The velocity of a projectile only increases until it clears the gun, at which point the resistance of the air commences to retard its velocity. 2. Is it known whether the gastric juice acts as rapidly on albuminous substances when diluted in a considerable quantity of water as it does when diluted in a small quantity of water? A. The gastric juice acts best on albumen when diluted with water only sufficient to make it fluid or to flow quickly.

(6229) C. E. B. writes: We have a metallic circuit telephone line about five miles in length using Bell's receivers as transmitters. The line runs parallel and almost under a telegraph line for about a mile; the part parallel to the telegraph is transposed every ¼ of a mile. Will transposing the other four miles reduce the effects of the earth currents? A. Yes; and if you were to use a twisted cable, it would be still better. When you say earth currents, we suppose you mean induction.

(6230) G. D. M. asks: What size air vent is required to allow water to fall through a 6 inch pipe to run freely? What is the minimum size pipe without, by reason of its size, affecting the capacity of the flow from such 6 inch pipe? A. As air issues through an orifice from 35 to 40 times the velocity of water under the same conditions of pressure, the air vent should be from 35 to 40 times less area than the water discharge orifice, so that if the whole area of the 6 inch pipe is to have a maximum flow, the vent should be $\frac{\text{Area}}{35}$ or $\frac{28}{35}$ = 0·8 of a square inch orifice, or a hole about 1 inch diameter, and in proportion for any size orifice for discharge of water. Seven-tenths of a square inch would be the minimum size for a full flow, as above, under favorable circumstances.

(6231) J. F., Ontario, writes: There is a flat roof in this town covered with leaded tin, and I wish to put a galvanized iron covering on over the old tin one, as it will be more convenient to do so, the old one keeping out rain while the new one is going on. What I am in doubt about is this: Will there be any possibility of chemical or electrical action taking place, so as to destroy the galvanized iron? A. There is no objection to the placing of a galvanized iron sheeting directly upon the old tin roof. Condensation, if any, will take place on the under side of the tin, and will not injure galvanized iron as much as if the condensation takes place upon the galvanized iron. The contact or small space between the two roof sheets will be too small to allow of condensation that will do any harm by rust or electrical action, which will be very feeble with dry surfaces in contact.

(6232) T. S. C. asks how to make a lubricator for burnishing photographs.

A.

1. Paraffine	8 drm.
Benzine	10 oz.

B.

Gum ammoniacum	30 grn.

Alcohol, quantity sufficient to prevent the gum from sticking to the pestle while grinding the gum in a mortar. Add A and B together, and shake well, and apply with a flannel or rag. The above gives a fine polish.

2. Lubricator for Hot Burnishing.

Cetaceum	1 part.
Castile soap	1 "
Alcohol	100 "

(6233) A. J. C. says: How may tattoo marks be removed? A. Dr. Variot, of the Paris Biological Society, advises the following method: Tattoo the skin, in the usual way, with a concentrated solution of tannin, following the original design. Then apply a crayon of nitrate of silver until the part tattooed with the tannin blackens. Wipe off excess of moisture and allow matters to take their own course. Slight pain continues for two to four days, and after two months the cicatrix which results will almost disappear.

(6234) F. F. C. asks how to make a composition for padding paper? A. The regular composition used is made from best glue and glycerine and water colored with aniline. This needs heating. A solution of gum tragacanth with a little glycerine might answer your requirements, but we advise the first. For 5 pounds of dry glue allow 1 pound of glycerine.

(6235) C. H. T. says: How can I produce ozone in a simple way? A. Ozone may be easily produced by means of an aqueous solution of permanganate of potash and oxalic acid. A very small quantity of these salts placed in an open porcelain dish is all that is necessary, the water being renewed occasionally, as it evaporates. Metallic dishes should not be used.

(6236) R. L. J. asks how to prepare fire kindlers? A. Dip the wood in melted resin. The following composition is sometimes used: 60 parts melted resin and 40 parts tar, in which the wood is dipped for a moment. Or, take 1 quart of tar and 3 pounds of resin, melt them, then cool; mix as much sawdust with a little charcoal added as can be worked in. Spread out on a board, and when cold break up into lumps the size of a hickory nut, and you will have enough kindling to last a good while.

(6237) B. C. U. says: Can you give me a method for cleaning nickel plated signs? A. Rouge, with a little fresh lard or lard oil, on a wash leather or piece of buckskin. Rub the bright parts, using as little of the rouge and oil as possible; wipe off with a clean rag slightly oiled. Repeat the wiping every day, and polish as often as necessary.

(6238) H. J. M. says: Can you inform me how I can render corks impervious? A. Bousquet's Patented Process.—The corks should be heated to 212° Fah., in order to kill any spores which they might contain. While the corks are hot dip them in a solution of 1 part albumen (egg or blood albumen) in 200 parts water; afterward dip in another solution composed of 1 part tannic acid, ½ part salicylic acid, and 200 parts water. Tannate of albumen is formed in the pores of the corks. Salicylic acid acts as an antiseptic.

(6239) A. A. H. says: What is the record for the voyage between New York and Liverpool? A. The fastest trip on record between Sandy Hook and Daunt's Rock was made by the Lucania on the trip ending Sept. 14, 1894; time, 5 days, 9 hours and 45 minutes. On the preceding voyage of the same vessel (westward) the time was identical, but the eastern course was longer, so that the speed was greater.

(6240) W. A. J. asks for an adhesive paste. A. Take 4 oz. common gelatine in small pieces and steep it in 16 oz. water until it becomes soft; then by the aid of the heat of a water bath dissolve it; and while still hot pour into a mixture of 2 lb. good flour paste and 1 pt. water. Heat the whole to boiling, and when thickened remove from the fire; while cooling add 6 drm. silicate of soda and stir into the mixture with a wooden spatula. This preparation will keep good for an indefinite period, and is very adhesive. The addition of 2 drm. oil of cloves is an improvement.

NEW BOOKS AND PUBLICATIONS.

AMERICAN SOAPS. A Complete Treatise on the Manufacture of Soap, with Special Reference to American Conditions and Practice. By Henry Gathmann. Chicago, U. S. A.: Henry Gathmann, 32 Market Street. 1893. Pp. 334. Price $15.

This excellent work deserves special attention, and a greater space than we can afford it. The keynote of the book is up to date practice. The author has not drawn upon a list of antiquated works to effect a compilation of disused processes, but has given the details of approved American practice, and of such European methods as are available for use to-day. The effort has been to produce a practical book, and to exclude matter of purely theoretical interest, not bearing upon the needs of the soap manufacturer. It is pleasant to find a technical work on a manufacturing subject compiled in this spirit. A list of the titles of the chapters might be given, to indicate the ground covered, but it is enough to say that our author seems to have omitted no essential topic. The book is beautifully printed and made, has numerous illustrations and full table of contents and index.

POOR'S RAILWAY MANUAL. New York: H. V. & H. W. Poor. 1894. Pp. 1392-134. Price $7.50.

This is the twenty-seventh annual number of this work, a publication which is invaluable to all investors in railway stocks and bonds, or financially interested in railway operations. It includes statements of the business of some 2,000 companies of the United States, showing, with all necessary detail in most cases, the official figures of their resources and liabilities, setting forth the conditions of leases and consolidations, dividends paid, the comparative returns for freight and passengers for a series of years, and the extension of old or construction of new lines. It is the only work of the kind published. The book also includes similar information as to the railroads of Canada and Mexico, street surface railways, and the leading industrial corporations, with an exposition of the industrial and financial resources of the United States and statements of State and municipal indebtedness. An appendix affords a complete list of officials of all operating railroad companies.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

September 11, 1894,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid, etc., apparatus for condensing nitric, E. Hart ... 525,761
Advertising device, R. D. Knight ... 525,740
Air brake for cars, J. F. Voorhees ... 525,876
Album, cabinet, J. M. Ray ... 525,719
Alcoholic liquors, preparing and making fermented, J. Takamine ... 525 819
Amalgamator, J. Jett ... 525,984
Ammonia, apparatus for making anhydrous, P. J. McMahon ... 525,858
Annunciator, electric, H. C. Thomson ... 525,874
Arm rest, self-adjusting, W. A. Kirby ... 525,766
Armature for dynamo-electric machines, R. Eickemeyer ... 525,698
Armatures in dynamo machines, winding for drum, R. Eickemeyer ... 525,697
Autographic register, W. Assheton ... 526,003
Balancing rotating parts, device for, G. W. Rymes ... 525,799
Baling press, G. W. & G. A. Davis ... 525,841
Bearing, ball, J. W. Howard ... 526,013
Bearing for clothes wringers, A. R. Sauters ... 525,722
Bedstead, adjustable, T. A. Martin ... 525,959
Bedstead, invalid, G. E. Gorham ... 525,952
Beehive, J. N. Sheffield ... 525,747
Beer dispensing apparatus, D. Leacock ... 525,955
Bell, bicyle, A. A. Page ... 525,862
Belt fastener, A. Mills ... 525,790
Bicycle, E. W. Scott ... 525,724
Bicycle gearing, V. Cruser ... 525,694
Bicycle lock, S. C. Hone ... 525,953
Bicycles, self-supporting attachment for, F. H. Kinder ... 525,954
Bin. See Flour bin.
Blind hanger and guide, N. Saltmarsh ... 525,745
Block. See Paving block.
Blotter holder, A. Weinandy ... 525,880
Blowers, packing box for rotary, W. W. Wainwright ... 525,776
Boat. See Dumping boat.
Body shield, W. F. Keogh ... 525,710
Boiler. See Tubular boiler.
Boiler furnace, E. Boileau ... 526,006
Boiler or steam generator, C. D. Mosher ... 525,856
Boiler setting, C. V. Kerr ... 525,907
Boiler tube attachment, C. W. Whitney ... 525,932
Boot or shoe, Briggs & Dancel ... 525,974
Boot-tree, W. J. Yapp ... 525,934
Borings at bottom of deep waters and in tide-ways, means for making, A. W. Palmer ... 525,795
Bottle stopper, C. N. Brisco ... 525,883
Bottling machine, E. Stahl ... 525,869
Box lifter, H. Eddishaw ... 525,949
Box top, L. Miller ... 525,917
Brake. See Air brake. Rail brake. Wagon brake.
Buckle, trace, L. L. Booth ... 525,973
Buggy top support, W. W. Krutsch ... 525,986
Buildings, constructing, Klein & Rowenhagen ... 525,847
Bung, J. Baeumle ... 525,833
Button attaching machine, W. E. Elliott ... 526,012
Cabinet, copybook, Ashbrook & Ingram ... 525,935
Calcimine, G. S. Adams ... 525,804
Camera. See Photographic camer.
Can. See Oil can. Paper can.
Capsule, R. P. Hobbs ... 525,845
Capsule pin and capsule, R. P. Hobbs ... 525,844
Car attachment, express, Koehler & Marten ... 525,713
Car coupling, E. N. & J. J. Byers ... 525,734
Car coupling, A. S. Edey ... 526,011
Car coupling, J. Reed ... 525,796
Car coupling, L. Showalter ... 525,802
Car, dumping, G. T. Morris ... 525,741
Car, dumping, E. A. Trapp ... 525,727
Car fender, S. A. Darrach ... 525,977
Car fender, street railway, Hollingsworth & Weaver ... 525,902
Car, hand, J. McMurrin ... 525,919
Cars by electricity, system of lighting and heating, M. Moskowitz ... 525,992
Cars, combined brake and electric switch for street railway, G. Brown ... 525,782
Carbons for electric lamps, manufacture of, T. A. Edison ... 525,888
Card teeth, method of and means for manufacturing, J. Platt ... 525,997
Carpet sweeper, H. W. Ru Ton ... 525,721
Carriage body, convertible, C. Klauberg ... 525,908
Carriages, runner attachment for children's, G. Nadeau ... 525,964
Cart, child's, F. C. Hannahs ... 525,705
Case. See Drawer case. Money changer's case.
Cash register and indicator, C. L. Lilleberg ... 525,956
Casket fastener, J. C. Edward ... 525,842
Caster, L. B. Denton ... 525,806
Cattle guard, L. Hills ... 525,900
Chop grading machine, J. A. McAnulty ... 526,017
Churn, E. H. Baugh ... 525,938
Churn, Fry & Hamilton ... 525,980
Churn, Rouse & Schonhoff ... 525,865
Clipper, hair, M. G. Gillette ... 525,783
Clock, electric, F. L. Gregory ... 525,704
Clock synchronizing mechanism, electric, E. Ayres ... 525,779
Closet. See Flushing closet. Water closet.
Cock, ball, J. H. Stevens, Jr ... 525,870
Cold storage building, A. L. Dexter ... 525,695
Composition of matter, J. E. Summers ... 525,926
Condensing apparatus, steam, W. Webster ... 525,931
Cooking utensil, R. M. Shaffer ... 525,968
Copper, process of and furnace for smelting, A. O. Vicuna ... 525,773
Cotton picker, A. Levedahl ... 525,911
Coupling. See Car coupling. Hose coupling.
Crate cover, etc., shipping, M. Backstrom ... 526,004
Culinary vessel, D. C. Wood ... 525,933
Cultivator, H. M. Burdick ... 525,838
Cup. See Dose cup.
Cutter. See Miter cutter.
Dam, F. H. Bainbridge ... 525,834
Delivery apparatus, coin-freed, L. Cecchi ... 525,692
Dental apparatus, F. M. Osborn ... 525,816
Dental pellet, G. B. Richmond ... 525,797
Dental pellet machine, G. B. Richmond ... 525,798
Dental plugger, A. A. Nouel, Jr ... 525,920
Diastatic enzyme, making, J. Takamine ... 525,823
Dissolving, leaching and filtering, method of and apparatus for, Storer & Lacy ... 525,970
Doll, mechanical, D. S. McElroy ... 525,716
Door closing device, automatic, C. Wincklhofer ... 525,830
Dose cup and bottle, combined, M. O. Turner ... 525,753
Doubletree, vehicle, S. J. McDonald ... 525,994
Draught equalizer, E. L. Thoms ... 525,873
Draw bar guide, H. W. F. Jaeger ... 525,904
Drawer and shipping box, combined, J. G. Walsh ... 525,972
Drawer case, D. E. Hunter ... 526,014
Dredge, E. S. Bennett ... 526,005
Drier. See Fiber drier.
Drier, T. Craney ... 525,758
Drilling machine, N. Remmel ... 525,742
Drum, heating, H. I. Grennell ... 525,896
Drum, heating, W. H. B. Lyons ... 525,990
Dry closet and urinal system, W. W. Ensign ... 525,808
Drying machine, J. K. Proctor ... 525,921
Dumping boat, W. McMahon ... 525,794
Dynamos, means for equalizing electromonive force of, M. Moskowitz ... 525,993
Electric machines, self-adjusting brush for dynamo, W. L. Bliss ... 525,836
Electric motor, J. S. Losch ... 526,016
Electric switch, G. Baehr ... 525,936
Electric transformer, C. S. Bradley ... 525,689
Electric wire fastener, H. C. Fricke ... 525,891
Electrical distribution, system of, J. F. McElroy ... 525,769
Electrolytic apparatus, E. Andreoli ... 525,732
Embroidery, removing background from, G. Hauser ... 525,738
Engine. Gas engine. Rotary engine. Traction engine.
Engines, electrical igniter for gas or hydrocarbon, P. A. N. Winand ... 525,828
Evaporator. See Salt evaporator.
Explosive compound, B. C. Pettingell ... 525,996
Fan, electric, C. Wachtel ... 525,730
Fan, ventilating, J. D. G. Thompson ... 525,928
Fastening device, F. W. Starr ... 525,748
Faucet, C. H. Dunton ... 525,948
Fence, wire, D. Garst ... 525,701
Fertilizer distributer, L. Roat ... 525,922
Fiber drier, F. G. & A. C. Sargent ... 525,967
Fifth wheel, S. K. Paden ... 525,995
File for index cards, A. Dom ... 525,947
Filling machine, Wallis & Galbraith ... 525,827
Fire kindler, E. Ludde ... 525,912
Flexible joint, A. Campbell ... 525,884
Flour bin and sifter, C. F. Burnap ... 526,009
Flue cleaner, boiler, P. H. Enochs ... 525,699
Flushing closet, ventilated, G. D. Curtis ... 525,759
Furnace. See Boiler furnace. Heating furnace.
Furniture joint, school, G. M. Bennett ... 525,756
Game counter, Ward & Ball ... 525,777
Gas engine, J. McGeorge ... 525,857
Gas motor, ammoniacal, P. J. McMahon ... 525,859
Gold washing and separating apparatus, J. B. Irvin ... 525,983
Grain meter, F. F. Kanne ... 525,764, 525,7 5
Grate, E. Boileau ... 525,805
Grinder, feed, T. Cascaden, Jr ... 525,976
Grinding machine, Beairsto & Beckwith ... 525,939
Gun barrels, device for attaching magazines to, L. L. Hepburn ... 525,739
Hanger. See Blind hanger.
Harrow, reversible overlap disk, T. B. Montgomery ... 525,960
Harvester, S. D. Locke ... 525,957
Harvester, B. F. Stewart ... 525,817
Hay carrier, P. A. Myers ... 525,715
Heating and ventilating apparatus, W. W. Ensign ... 525,807
Heating furnace, L. Jackman ... 525,763
Hinge, J. B. Knittel ... 525,712
Hinge, shutter, A. O. Elzner ... 525,843
Hinge, spring, A. A. Page ... 525,860, 525,861
Hitching device, rope, E. F. Parker ... 525,770
Hoisting device, W. E. Tretheway ... 525,875
Hoisting drum, H. Bolthoff ... 526,007
Hook. See Lacing hook. Wardrobe hook.
Hooks and eyes, machine for making and carding, A. D. Major ... 525,914
Hop cleaning machine, R. J. & J. P. Mackison ... 525,913
Hose coupling, W. Martin ... 525,854, 525,855
Hulling and cleaning machine, C. E. Lipe ... 525,813
Ice handling implement, D. C. Ryder ... 525,923
Ice machines, freezing plate for, C. S. Booth ... 525,733
Indicator. See Station indicator.
Insole for slippers, A. Sessler ... 525,746
Insulating support, bus-bar, A. B. Herrick ... 525,708
Jack. See Lifting jack. Lifting or log jack.
Joint. See Flexible joint. Furniture joint.
Journal box, W. W. Wainwright ... 525,774, 525,775
Kettle, cooking, B. C. Sabin ... 525,924
Kitchen cabinet, J. L. Swink ... 525,750
Knife. See Skinning knife.
Knob attachment, T. E. Wardwell ... 525,877
Lacing hook or stud for shoes, gloves, etc., G. S. Pearson ... 525,718
Lamp, R. M. Dixon ... 525,696
Lamp, electric arc, H. E. Bradley ... 525,943
Lamp, electric arc, S. L. Campbell ... 525,735
Lamp, electric arc, A. B. Roney ... 525,743
Lamp stand and reflector, incandescent, G. F. Klemm ... 525,909
Lamps, spark shield or protector for electric arc, W. M. Tompkins ... 525,929
Latching device for double doors, I. Johnson ... 525,906
Lathe, metal turning, S. W. Putnam ... 525,863
Lead, making white, Waller & Sniffin ... 525,826
Leather, making artificial, H. Krum ... 525,985
Lifter. See Box lifter.
Lifting jack, L. Foix ... 525,890
Lifting or log jack, E. & A. G. Hayford ... 525,706
Lightning arrester, A. L. Courtright ... 525,840
Lock. See Bicycle clock.
Logging apparatus, A. W. Brown ... 525,944
Loom shuttle, J. H. Morin ... 525,814
Manual recorder and indicator, H. Cook ... 525,839
Mash, alcoholic ferment, J. Takamine ... 525,825
Match making machine, L. H. Montross ... 525,791
Medicinal food and preparing same, E. O. Taflin ... 525,818
Meter. See Grain meter.
Milling machine, E. J. McClellan ... 525,792
Miter cutter, C. E. Smith ... 525,725
Money changer's case, W. H. Staats ... 525,726
Mop wringer, C. A. White ... 525,803
Motion, mechanism for taking up lost, J. W. Boynton ... 525,780, 525,781
Motion, mechanism for taking up lost, E. H. Parks ... 525,771
Moto, preparing and making, J. Takamine ... 525,821
Motor. See Electric motor. Gas motor.
Music boxes, spring motor for, G. Otto ... 525,717
Newspaper holder, A. B. Smith ... 525,868
Nut, self-locking, A. A. Brown ... 525,837
Oil can, J. C. Roth ... 525,744
Oil can, siphon, I. Brokaw ... 525,975
Oils, desulphurizing mineral, A. Sommer ... 525,969
Oils, purifying sulphur compounds of mineral, L. O. Helmers ... 525,784
Oven, Erben & Koch ... 525,760
Oven, baker's, F. Duhrkop ... 525,736
Paper can, G. H. Bartlett ... 525,937
Partitions, iron frame for fireproof, A. M. Houston ... 525,903
Paving block, J. H. Amies ... 525,832
Pen fountain, E. M. Gorden ... 525,895
Pencil, G. R. Sandell ... 525,966
Pessary, J. A. Hurdle ... 525,785
Petroleum, refining, H. A. Frasch ... 525,811
Photograph flash lamp, A. Hemsley ... 525,899
Photographs, apparatus for developing, etc., E. F. Mackusick ... 525,849
Photographic camera, series, M. Mayer ... 525,991
Picker. See Cotton picker.
Planter, combined corn and cotton, W. C. Sanders, Jr ... 526,000
Planter, potato, F. Gaunt ... 525,893
Planter, potato, M. F. Myers ... 525,918
Plow, R. E. Hopkins ... 525,762
Plow, H. A. W. Smith ... 525,867
Plow, submarine, J. Halton ... 525,897
Press. See Baling press.
Propelling vessels, hydraulic method of, J. Widmer ... 525,881
Pulp grinding machine, A. Karger ... 525,846
Pump, H. Mortensen ... 525,714
Pump, Reed & Apgar ... 525,998
Pump, automatic hydraulic, T. A. Walther ... 525,731
Pump, oil well, S. C. Turner ... 525,728
Punches or presses, means for operating, E. B. Stimpson ... 525,871
Punching machine, E. B. Stimpson ... 525,872
Puzzle, M. A. Klein ... 525,767
Rail brake, G. Sands ... 526,001
Railway, electric, H. E. Rider ... 525,864
Railway, gravity, A. Witschold ... 525,882
Railway signal carrier, N. A. Faus ... 525,889
Railway signaling apparatus, electrical, P. Schwenke ... 525,866
Railway system, electric, C. S. Bradley ... 525,690
Railway tie, metallic, E. L. Taylor ... 525,927
Railway trolley, electric, E. Dawson ... 525,886
Railways, conduit system for electric, W. G. Creighton ... 525,945
Recorder. See Manual recorder.
Refrigerator and beer cooler, L. Leyendecker ... 525,787
Refrigerator drip trough, C. W. Hinrichs ... 525,901
Refrigerator shelf, J. Schambrue ... 525,723
Register. See Autographic register. Cash register.
Register, W. M. Dyas ... 525,887
Ring making machine, F. Mossberg ... 525,961
Roaster, N. H. Jensen ... 525,905
Roll holder, W. H. Lewis ... 525,786
Rotary engine, J. F. McElroy ... 525,793
Sales slip, Shepherd & Flagg ... 526,002
Salt evaporator, T. Craney ... 525,757
Sash fastener, F. F. Unkrich ... 525,930
Sash holder, T. C. Maris ... 525,851
Sash, removable window, J. Lehnbeuter ... 525,987
Satchel, sheet metal, H. Macarthy ... 525,848
Saw tooth, insertible, R. Marquart ... 525,852
Scale, price, H. E. Knottnerus ... 525,910
Seed hulls and separating lint and hulls, detaching lint from cotton, J. P. Burnham ... 525,691
Sewing machine, Clark & Willis ... 525,885
Sewing machine, J. H. Way ... 525,879
Sheet separating and printing machine, C. Reising ... 525,999
Skinning knife, J. A. Foster ... 525,737
Sower, hand seed, W. R. Bowen ... 525,942
Spinning frame separator, G. A. & G. O. Draper ... 526,010
Spinning mule attachment, F. H. Lewington ... 526,015
Spoke and tire tightener, J. M. Hawley ... 525,981
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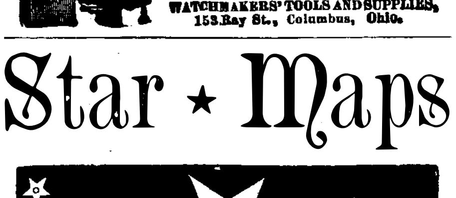

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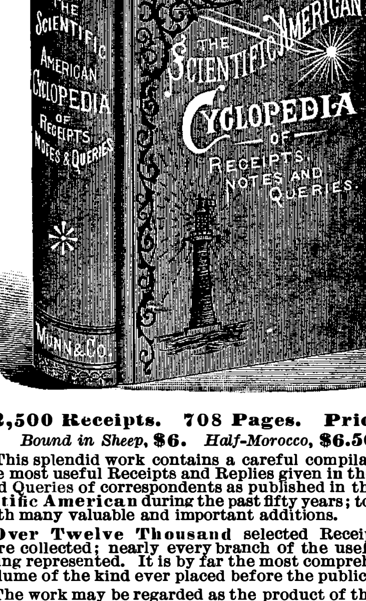

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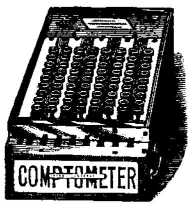

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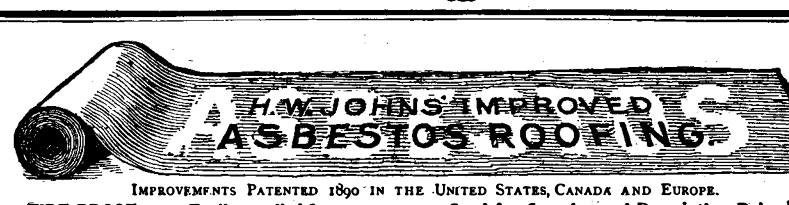

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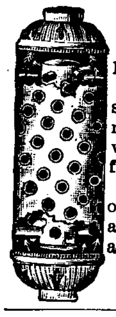

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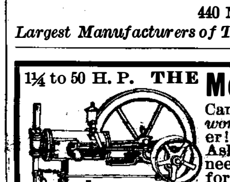

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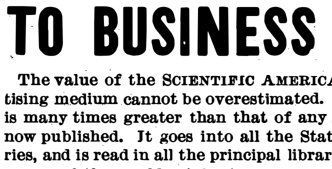

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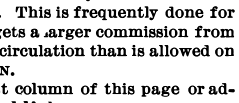

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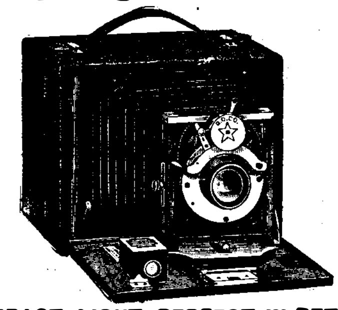

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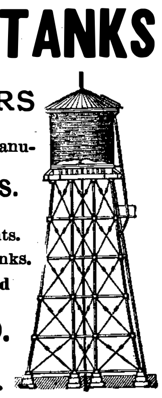

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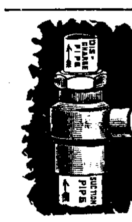

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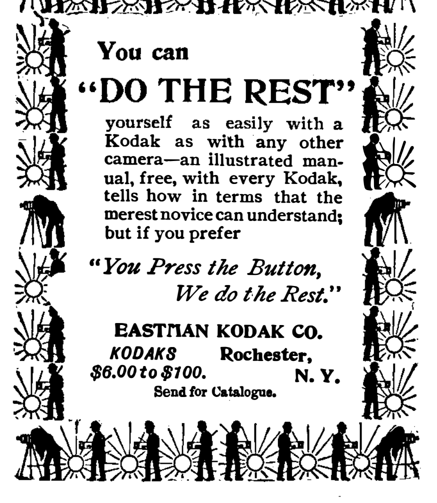

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